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Tax Competition
Theories and Their Developments

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During the recent decades corporate income tax rates have declined. This development may be due to several issues, such as changes in the political environment or increased knowledge of behavioral effects of corporate taxation. One prominent explanation is tax competition. Tax competition is defined as noncooperative tax regime setting by independent governments such that the tax policy decisions affect the allocation of mobile tax base(s) among different countries. Tax regimes include the statutory tax rates as well as the tax bases and other parts of corporate tax systems.

Tax competition is an important phenomenon for multiple reasons. Lower tax rates may imply issues in financing the public sector. On the other hand, it makes some of the issues of the international corporate tax system visible. This thesis reviews theories of tax competition. The aim is to provide an analysis of the different aspects of tax competition and review how different institutional structures are modelled in tax competition framework. Studying the main implications of tax competition is an important part of the thesis.

The first formal models of tax competition consider a world economy which consists of many identical countries. Firms maximize profits and governments maximize utility of the representative agent. It is shown that tax competition drives tax rates to an inefficiently low level. Later tax competition research develops both the institutional set-up of tax competition and modelling frameworks applied to study it.

The results of this thesis imply that the result of the first tax competition models is strong. Tax competition drives corporate tax rates to an inefficiently low level even if the key assumptions are relaxed. On the other hand, some important extensions imply that corporate income tax rates are in an optimal level even in presence of tax competition. However, in most cases tax competition is harmful since it drives corporate income tax rates to inefficiently low levels.

On the other hand, tax competition literature also provides other results. Considering sequential tax competition instead of simultaneous shows that tax rates may in equilibrium be higher if one country acts as a leader. This may be one explanation why tax rates have not declined to zero as the famous race to the bottom hypothesis suggests. Tax competition literature also provides analysis on the effect of tax havens. These results are, however, more confusing. Tax competition can decrease welfare or be welfare improving.

This thesis reviews important aspects of tax competition literature and focuses on the institutional set-up of theories of tax competition. There remain some gaps in the literature. Some institutional set-ups are not analysed in the tax competition context. On the other hand, literature focusing on the empirics of tax competition is scarce. One of the important aspects of tax competition is how to limit it. This issue has a great amount of current attention in the work of OECD, for example.

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Contents

1 Introduction

The statutory corporate tax rates have declined during the recent decades. Devereux et al. (2002), Griffit and Klemm (2004) and Loretz and Notes (2008) highlight the importance of the decline and argue that the statutory corporate tax rates lowered rapidly during the second half of the 1900s. Decline continues in the 2000s. During the past 20 years the statutory corporate tax rates declined from approximately 30 percent to about 20 percent (OECD 2019). For example, one of the famous recent reforms, the Tax Cuts and Jobs Act of 2017, lowered the statutory corporate tax rate of United States from 35 percent to 21 percent.

This development may be a result of several factors. Knowledge of the distorting nature of corporate taxation is more understood. Gained knowledge may affect tax policies. On the other hand, political atmosphere may have an effect. Slemrod (1992) argues that the shift in the macroeconomic paradigm in the 1960s and the 1970s meant a shift to more positive attitudes towards reducing tax rates. It is also possible that the rise of digital economy affects corporate taxation. Kari and Ropponen (2018) argue that the rise of digital business reveals issues in international corporate tax system. Since countries do not have possibilities to affect the behavior of digital businesses they reduce their level of corporate taxation.

One possible reason for the decline is international tax competition. International competitive pressures may affect the corporate tax policies of countries. Especially multinational corporations have possibilities to relocate and the tax rate differentials may play a key role in the location choices. Governments may recognize this mechanism and behave strategically in tax policy setting. Tax policy responses of other countries are taken into consideration when making tax policy choices. Devereux et al. (2008) and Egger and Raff (2015), among others, find empirical evidence on tax competition.

Tax competition is an important theme for multiple reasons. It is an interesting phenomenon and it has implications for public finances. Tax competition may lead to race to the bottom. This means that corporate tax rates may be driven down to zero. Very low tax rates may mean very low tax revenues. Public expenditures are increasing in many countries due to aging (Aalto et al. 2020; Sirviö 2020). Corporate tax revenue is an important part of tax revenue and it may be problematic to unite declining revenues and increasing expenditures.

Tax revenue has remained stable although statutory tax rates have declined as Devereux et al. (2002) argue. This contradiction reveals the complexity of tax competition. It may be that tax competition affects the total tax revenue through another mechanism. Mooij and Nicodème (2008) argue that tax competition causes a shift from the individual income tax revenue to the corporate tax revenue and erodes the individual income tax revenue. On the other hand, the contradiction

may be explained by increased economic activity (Fuest et al. 2020), tax base broadening (Loretz and Notes 2008) or changes in the distribution of capital and labor income.[1]

Tax competition is problematic for yet another reason. Tax competition is interconnected with tax avoidance as Faulhaber (2017) argues. Tax competition can be viewed as actions of countries to attract firms whereas tax avoidance is the behavior of firms to save taxes. Tax competition is, thus, partly caused by tax avoidance behavior such as profit shifting and tax haven operations. Since tax avoidance behavior offers some agents different rules tax competition may through tax avoidance be a problem for the legitimacy of the tax systems as Sirviö (forthcoming) argues.

Although there is empirical research on tax competition it is especially a theoretical research topic. The idea of tax competition is present in the work of Tiebout (1956) and Oates (1972) but the first formal models of tax competition are presented by Zodrow and Mieszkowski (1986) and Wilson (1986). These models argue applying a framework in which firms optimize and governments maximize utility of the representative agent that tax competition leads to underprovision of public goods in Samuelson‘s (1954) sense.

First models of tax competition consider a situation in which countries are symmetric and capital is perfectly mobile. The key result of these models is that an increase of corporate tax rate in one country results in an outflow of capital to other countries. Countries with lower corporate tax rates attract the capital. Countries need to take into consideration the corporate tax policy of other countries. Countries do not cooperate and end up setting corporate tax rates too low. This implies that public goods are underprovided.

After the first models tax competition literature has expanded. The first extensions consider tax competition in cases with, for example, asymmetric countries (Bucovetsky 1991) or imperfect competition (Hoyt 1991). More recent tax competition literature considers current issues in corporate tax environment. There is, for example, a growing discussion about tax havens and their impact on tax revenue and welfare of the high tax countries (Slemrod and Wilson 2009; Hong and Smart 2010).

Part of tax competition literature focuses on reviewing earlier literature. There are two broad literature reviews focusing on different aspects of tax competition. Wilson (1999) reviews tax competition in different institutional frameworks and adds layers to basic tax competition model. The main conclusion of the review is that the underprovision result holds with assumptions more general than in Zodrow

[1]There is little evidence on the dynamics between tax competition and the distribution between capital and labor income. However, the share of labor income has declined in many countries in the long run (Rodriguez and Jayadec 2010; Karabarbounis and Neiman 2014). This development may help to explain the contradiction between the development of tax rates and tax revenues.

and Mieszkowski (1986). More recent review is provided by Keen and Konrad (2013). The emphasis on their review is on policy issues relating to limiting tax competition.

In addition, there are reviews that are narrower in scope. Zodrow (2003) considers tax competition literature in light of the European integration. The focus is on the policy view. Baskaran and Lopes de Fonseca (2014) focus on the possible tax harmonization of the European Union countries. Genschel and Schwarz (2011) present literature review that differs from other tax competition literature reviews by considering less theory and more the institutional framework and the legislational views. Zodrow (2010) considers in which manner is capital mobile and how has the mobility affected tax competition.

Based on an analysis of the earlier survey literature there is a gap in it. There is no literature review that would provide a comprehensive outlook on different institutional issues studied in tax competition framework. For example, effect of labor markets, agglomeration and political process are studied in tax competition literature. In addition, there is no literature review that would provide survey of different methodologies applied to model tax competition. Early models of tax competition build on microeconomic framework but also macroeconomic models are important part of the tax competition literature.

This thesis aims to fill the gaps in the review literature. The research question of the thesis is that how should the canonical tax competition model be defined and what are the implications of tax competition according to the theoretical literature. In order to answer these questions theories of tax competition are reviewed.[2] Keen and Konrad (2013) argue that the future research requires less simplistic view on international tax regime. This, in turn, requires a deeper understanding of the institutional issues and their role in tax competition. On the other hand, less simplistic view on international tax regime can be obtained by widening the methodology applied to study tax competition.

This thesis focuses on describing tax competition and the dynamics of it. In order to make the analysis more approachable the research question is divided to themes. The first theme concerns the definition of the canonical tax competition model. Earlier tax competition literature uses definitions like the canonical tax competition model and workhorse models. There is no agreement on the definitions. Different reviews and different research articles include partly different models to these definitions. Therefore, this thesis reflects the differences in the earlier literature and provides a new definition for the canonical tax competition model. This definition aims to harmonize the terminology applied in the literature.

[2]This thesis focuses on international corporate tax competition. Sometimes tax competition refers to commodity tax competition. This strand of literature started from the model by Keen and Kabur (1993). Another prominent field in the tax competition literature is regional tax competition. Some of these models are briefly discussed in this thesis but the main focus is on international corporate tax competition.

The second theme of the research question is focused on the implications of tax competition. Three subquestion are posed. Firstly, is it considered whether the classical underprovision result holds with more general assumptions. This subquestion tests whether the result of Wilson (1999) presented earlier can still be reproduced. The underprovision result is an important part of tax competition literature. Some models apply a different methodology and do not model underprovision of public goods. The second subquestion is that what are the most important implications of the models that do not model underprovision of public goods. There is disagreement in tax competition literature whether tax competition is harmful or not. The third subquestion is to whether it is suitable to call tax competition harmful or not.

Recent tax competition literature studies important themes such as limiting tax competition and empirical views on tax competition. Compared to the review focusing on coordination issues by Keen and Konrad (2013) this thesis reverses the set-up. Issues of limiting tax competition are important but out of the scope of this thesis. In addition, empirical tax competition literature is important field in modern tax competition literature but out of the scope of this thesis[3].

The methodology of the thesis is descriptive integrative literature review. Tax competition literature is reviewed focusing on describing the literature and integrating it to reasonable entities. Salminen (2011) argues that descriptive literature review allows to describe certain phenomenon throughoutly and categorize parts of the phenomenon. Baumeister and Learyn (1997) argue that literature review is an ambitious way to develope current theory and to build new theories. Theory can be evaluated using literature review. It seems natural to choose descriptive integrative literature review as the methodology for descriping the theories of tax competition.

The thesis proceeds as follows. Chapter two discusses the institutional backround of tax competition. Chapter three discusses the canonical tax competition model. Chapter four furthers the perspectives on theories of tax competition. Chapter five concludes.

[3]For a literature review on the empirics of tax competition see Leibrecht and Hochgatterer (2012).

2 Perspectives on corporate taxation and tax competition

This chapter describes the institutional backround of tax competition. One of the key issues is the definition of tax competition. Although tax competition has an intuitive definition literature provides more spesific definition. Tax competition is strongly related to the historical development of corporate tax systems and the principles of international corporate taxation. These issues are discussed in two subchapters first of which discusses the early history of modern corporate tax system while the second focuses on recent issues and initiatives to limit tax competition. In addition, behavioral effects of tax competition are discussed.

Before proceeding to the subchapters it is useful to discuss the role of corporate income taxation in a more general level. Schjelderup (2015) argues that corporate income tax is useful because it serves as a backstop for personal income tax. If there would be no corporate taxation wealthy individuals would be able to shift their labour income to corporate income and pay no taxes. Corporate tax may also be useful for limiting income shifting between labour and capital income. Corporate tax is also a withholding tax on non-resident shareholders. Similar arguments in favor of taxing corporate income are given by Mirrlees et al. (2011) who also argue that taxing corporate income is important due to administrative inconvience and because of the backstop role of it.

Optimal capital tax theory is a prominent field which discusses the optimal amount of taxation. Although this field is out of the scope of this thesis it has interesting implication for corporate income taxation. Based on the optimal tax theory there may or may not be a positive corporate income tax. The early studies of optimal capital taxation by Chamley (1986) and Judd (1985) find that the optimal level of capital taxation is zero in the long run. This implies that corporate tax should be set to zero. These models obtain asymptotical result of no capital taxation using a general equilibrium model. Straub and Werning (2020) question the assumptions used by Chamley (1986) and derive positive optimal capital tax rate using the same model. In addition, Saez and Stancheva (2018) derive positive capital tax rates applying a different methodology.

2.1 Definitions of tax competition

Before proceeding further tax competition must be defined. There is no common definition of tax competition. Instead many definitions are used in the literature. Different definitions highlight different aspects of tax competition. The simplest definition of tax competition is that it is strategic behavior when setting corporate tax regimes or a situation in which governments experience international competitive

pressures when setting corporate tax regimes. These definitions are useful for every day use but literature provides more spesific definitions.

Early definitions of tax competition by Tiebout (1956) and Oates (1972) focus on highlighting the implications of tax competition. In a sense both of these definitions view tax competition as a situation in which governments experience pressures to lower corporate tax rates. Pressures are in place because otherwise factors of production may move to other regions. Tiebout (1956) concludes that tax competition is good because it implies that the preferences of the agents and the tax rates are consistent. Governments translate the preferences of citizens to suitable tax rate to provide the preferred amount of public goods. Oates (1972) argues that tax competition may be harmful because it may lead to a situation with too little money for public good provision. Thus, these approaches differ by the implications of tax competition. These definitions highlight the hamrfulness or efficiency enhancing nature of tax competition.

Instead of highlighting the implications of tax competition the definition of Wilson (1986) highlights the government actions in tax competition. Wilson (1986) divides tax competition to two classes. In the first case regions try to encourage investments through preferential treatment of certain industries or invesment types. In the second case regions want to increase the total level of capital investment by lowering their tax rates on capital. These definitions are broad and useful. They also depict what tax competition may mean in practice.

More spesific economic theory definitions of tax competition are presented by Wilson and Wildasin (2004). According to their definition tax competition is non-cooperative tax setting by independent governments such that these decisions affect the allocation of mobile tax base(s) among different countries. There is no cooperation between national governments in setting tax rates and part of the tax base is mobile. This means that capital moves across the borders. Mobility of capital is a crucial assumption of theoretical tax competition models presented in the following chapters.[4]

Statutory corporate tax rates are only one part of corporate tax regimes. In addition to statutory corporate tax rates governments may compete through preferential treatment or tax bases and depreciation allowances[5]. Thus, tax competition is a wider phenomenon than just competitive tax setting. The definition of Wilson and Wildasin (2004) can be seen to include other forms of competition. However, it favors to widen the definition and highlight the role of other forms of competition. This can be done by defining that instead of discussing about tax setting tax regime

[4]According to another definition of Wilson and Wildasin (2004) tax competition is defined to be noncooperative tax setting which affects the allocation of tax revenues between countries. Instead of the allocation of tax bases this definition highlights the role of the allocation of tax revenue.

[5]For a wider discussion of the role of preferential treatment and depreciation allowances in tax competition see chapter 3.2.5.

setting is discussed. Therefore, this thesis uses a modified definition of Wilson and Wildasin (2004) and defines that

> tax competition is noncooperative tax regime setting by independent governments such that these decisions affect the allocation of mobile tax base(s) among different countries.

This definition highlights that in addition to statutory tax rates tax competition may occur through other parts of tax system such as tax bases.

From the viewpoint of this thesis the aforementioned definition is sufficient. However, part of the literature defines tax competition based on whether it is harmful or not. Definitions of harmful tax competition are more present in policy discussion such as in OECD (1998) and in international law literature. Faulhaber (2017) discusses the division between harmful and non-harmful tax competition. For example, the overall low tax rates are not harmful tax competition but preferential treatment regimes are. Preferential treatment provided to immobile tax bases is not harmful tax competition. Tax havens are a part of harmful tax competition if the tax haven country is on the list of non-cooperative jurisdictions and lacks good governance[6]. If a tax haven country has good tax governance tax competition is not harmful. In the case of tax havens the quality of governance is, thus, an important issue when studying the possible harmfulness of tax competition.

Policy definitions of tax competition are interesting also because they live in time. Faulhaber (2017) argues that the definitions of harmful tax competition have changed from the early 2000s. The early 2000s definitions of harmful tax competition did not explicitly define tax havens or common tax base ideas which are present in the broader definitions of late 2010s. In addition, it is argued that tax competition and tax avoidance complement each other. Tax competition is often seen as the phenomenon in which governments compete in setting tax regimes to attract investments and firms. Tax avoidance is often seen as the phenomenon in which individual tax payers seek to exploit the opportunities to avoid taxes in especially countries with higher taxation. Thus, tax competition and tax avoidance can be seen as the reverse sides of the same issue.

2.2 History of corporate tax systems

Early modern corporate tax systems and principles of international corporate taxation were created at the turn of the 1900s. There were not many multinational corporations that operated in many countries. However, governments wanted to avoid the possibility of double taxation. Double taxation means a situation in which

[6]The list of non-cooperative regions is an effort by the European Union to enhance the international tax system. See Euroopan unionin neuvosto (2020) for a wider discussion.

the profit is taxed both in the home country of the multinational corporation and in the country of the affiliate. Therefore, there was un urge to set the principles of international corporate taxation.

The principles of international corporate taxation were created based on the work by a committee of the League of Nations in 1920s. The principles designed by the committee can be summarized by three pillars of international corporate taxation as Zucman (2014) does. The first pillar is that the tax should be paid on source country basis. Source country means the country where production happens. The second pillar is that multinational corporations should apply the arm‘s lenght principle. This means that the products should be sold with the same price to the buyers outside than those inside the corporation. The third pillar is that corporate tax issues should be solved by bilateral treaties between governments.

At the beginning of the 1900s corporate tax rates were relatively small. However, corporate tax rates increased during the first half of the century and peaked in the 1950s and 1960s. For example, according to Internal Revenue Service‘s statistics in United Stated the corporate tax rate was often above 50 percent in these decades. The statutory corporate tax rates declined from the 1960s onwards (Devereux et al 2002; Griffith and Klemm 2004; Loretz and Notes 2008). Griffith and Klemm (2004) find that the corporate tax revenues as a share of the gross domestice product have remained relatively stable on the period from 1965 to the beginning of the 2000s. In addition, they find that the corporate tax revenues as a share of the total tax revenue have declined from 1960s to 1980s but remained stable after that.

It is interesting that the statutory corporate tax rates decline but the tax revenues remain stable. One explanation may be that governments decreased statutory tax rates but broadened tax bases. Loretz and Notes (2008) highlight the role of base broadening. Slemrod (2018) even argues that lowering the statutory tax rate and broadening the tax base became a synonyme for corporate tax reform. For corporations tax base is the difference between costs and revenues. Tax base can be broadened, for example, by restricting depreciation allowances. If corporate tax base is broader the same amount of revenue can be collected via a lower statutory tax rate. On the other hand, contradiction between declining tax rates and stable revenue may be a result of other issues discussed in introduction.

Several issues may explain the decline of corporate tax rates. Tax competition is studied in a broader manner in this thesis. However, tax competition itself may not be sufficient explanation for declining corporate tax rates. As seen in the following chapter, theoretical tax competition literature rests on the assumption of internationally mobile capital. Capital was not mobile for part of the 1900s. To understand the decline of corporate tax rates one would have to understand how did the free movement of capital occur in the late 1900s.

Globalization and intellectual trends may have an impact on the mobility of capital. These issues are out of the scope of this thesis but there is at least narrative evidence on the effect they have. Slemrod (1992) argues that activist macroeconomic policy was at the high point in the 1960s and that the rise of the fear of stagnation, among other issues, resulted in the rise of supply side economics. For tax policy supply side economics meant that the reduction of tax rates was almost a value in itself. The change in the paradigm of macroeconomics may have an impact on economic policy. On the other hand, increased international competition for investment is possible because the movement of capital is freer than before. Liberating the capital markets is, in turn, a part of globalization which has amplified again since the 1970s as Taylor (2009) argues.

2.3 Recent initiatives to limit tax competition

The principles of international corporate taxation are designed for a different business environment than that of the 2000s. Therefore, it may be hard to apply these principles in current business environment (Kari and Ropponen 2018). For example, one of the principles is that tax should be paid to the source country. Defining the source country may be problematic in the current business environment with digital business platforms. On the other hand, current business environment consists issues such as tax havens which make it hard for governments to use their taxing power[7]. Because of these issues countries are willing to reconsider the principles of international corporate taxation.

Issues of international corporate taxation often demand international cooperation. A prominent form of international cooperation is The Organisation for Economic Co-operation and Development‘s (OECD) work to prevent harmful tax competition and the fight against corporate tax avoidance. The base erosion and profit shifting initiative (BEPS) is important as a part of this work. The objective of this initiative is to prevent erosion of corporate tax bases and limit profit shifting. Part of the work is done through pillars one and two. The first pillar focuses on issues relating to division of taxing rights and pillar two focuses on a proposal on minimum tax rate in order to prevent tax competition. Dharmapala (2019) argues that the initiatives of OECD may be effective in limiting profit shifting and that the phenomenon may, in fact, be disappearing.

OECD (2020a) reflects the issues relating to pillar one framework. The main challenge in current business environment is that the firms are able to generate profit in a way that makes taxing rights hard to allocate. In pillar one framework profits would be allocated in a way that consolitated financial accounts would serve as a starting point. Tax base would be determined in a way that complexity and

[7]For a wider discussion on tax havens see chapter 4.5.3.

burden for tax administration would be minimized. In addition, double taxation would be eliminated. There would also be a new multilateral tax certainty process and a new multilateral convention which would implement the solution proposed.

On the other hand, pillar two would especially address remaining base erosion and profit shifting challenges by setting out a rule which allows countries to "tax back" in cases where other countries have not applied their primary taxing rights (OECD 2020b). The pillar two propositions would ensure that the firms pay at least a minimum level of tax. Pillar two framework provides rules for calculating the effective tax rate and the allocation of the top-up tax for certain systems provided in the framework. In addition, pillar two framework provides model legislation. Multilateral convention is included to the framework of pillar two as it was in the framework of pillar one.

2.4 Behavioral effects of corporate taxation

Taxation affects the amount of goods produced and creates welfare losses since the optimal amount of production may not be produced. In addition, taxation has effects on real economic activity. For example, Romer and Romer (2010) show that tax increases have negative effect on economic growth. On the other hand, corporate taxation has effects on the behavior of the firms.

In modern business environment multinational corporations operate in many countries. Foreign direct investment (FDI) is an investment in which a multinational corporation invests in operations in other countries than it's home country. Tax policies may affect the incentives to invest in a certain country. Higher tax rate means lower after-tax returns. Other issues such as regulatory policies may also affect the decision of investment. Hines (1999) reviews the empirical literature on behavioral responses to international taxation and finds that corporate taxation affects foreign direct investment. Tax elasticity of investment is found to be -0.6. This means that if there is a ten percent differential in tax rates there is six percent less investments in the country with higher tax rate. Higher tax rate may lead to a lower level of investment.

Later literature amplifies the result that higher taxation has negative effects on foreign direct investment. Meta-studies collect and analyze the results of studies identifying the relationship between taxation and foreign direct investment. The meta-study by Feld and Heckemeyer (2011) creates a data set using 29 earlier studies and computes pooled fixed effect estimators and random effects estimators. The median tax semi-elasticity of foreign direct investment found is 2.49 while the weighted average of semi-elasticities is 2.55. If publication selection bias is considered the elasticity declines to 2.28 or 1.19. In addition, aggregate elasticities seem to be higher than the firm level elasticities.

In addition to choosing the location of foreign direct investment multinational corporations may respond to tax rate differentials by shifting profits. Profit shifting means that multinational corporations may shift paper profits from high tax countries to low-tax countries. Dharmapala (2014) argues that multinational corporations use especially transfer mispricing, inner loans and the location of immaterial rights as means to shift profits. These measures take advantage of the system of international corporate taxation by, for example, manipulating interest rates of concern loans.

Although profit shifting is often legal corporate tax avoidance might not be acceptable in the eyes of governments and citizens. Economics literature has different views on the acceptability of tax avoidance. Weisbach (2004) argues that tax avoidance could be thought as one behavioral response to corporate taxation and it should be punished only if it is socially optimal. On the other hand, authors like Zucman (2014) emphasize the suspicious nature of corporate tax avoidance. Research literature does not have a common view about the acceptability of tax avoidance.

Regardless of the problems with defining tax avoidance empirical research finds evidence on profit shifting behavior. Heckemeyer and Overesch (2017) conduct a meta study using 27 earlier empirical studies and 203 estimates. They find a tax semi-elasticity of pre-tax profit of 0.8. This means that if international tax rate differentials increase by one percentage point the reported profits decrease by 0.8 percents. This study also concludes that studies using aggregate data have higher estimates than studied using micro data and that it may be that aggregate data studies have overestimated the scope of profit shifting.

Beer et al. (2020) review corporate tax avoidance literature and find semielasticity of of reported pre-tax profit of unity. This is greater than concensus estimate of 0.8 by Heckemeyer and Overesch (2017). The authors argue that future research should consider whether different tools of profit shifting are complements or substitutes, how has corporate tax avoidance varied over time, between countries, and in different sectors and how has the anti-tax avoidance rules affected.

Literature has also aimed to identify public finance consequences of profit shifting. Lumme and Ropponen (2020) review the literature on tax revenue consequence of profit shifting and evaluate that profit shifting means worlwide tax revenue losses of hundreds of billions of dollars. On the other hand, Wang et al. (2020) argue that there are multiple reasons related to firm-level charasteristic that may affect the likelihood of a firm to engage in tax avoidance. Earlier studies show, for example, that tax avoidance is less frequent in family firms (Chen et al. 2010), that tax avoidance and the independence of the internal audit committee are negatively associated (Richardson et al. 2013) and that firm size and tax avoidance are positively associated (Lisowsky 2010).

Tax havens provide tax avoidance services and play a key role in tax competition. Small countries providing concealment services and very low tax rates to firms and wealthy individuals are called tax havens. Dharmapala and Hines (2009) argue that tax haven country is usually small in the sense that they often have below one million citizen and, in addition, it is often well governed and more affluent than other similar countries. Dharmapala and Hines (2009) find approximately 40 tax haven countries in the world. The impact of tax havens may be big. For example, Tørsløv et al. (2018) argue that multinational corporations shift 40 percent of their profits to tax havens.

3 The canonical tax competition model

The first formal presentations of tax competition are provided by Zodrow and Mieszkowski (1986) and Wilson (1986). These models formalize tax competition using a framework with firm optimization and governments maximizing utility of the representative agent. The main result of the first tax competition models is that tax competition leads to inefficiently low corporate tax rates and inefficiently low levels of public good supply. There is underprovision of public goods in Samuelson's (1954) sense. Later research applies partly different methodologies to study tax competition. Kari and Lönnqvist (2001) divide tax competition literature to two schools of thought. The first tradition is based on the ideas by Oates (1972) which are formalized by Zodrow and Mieszkowski (1986) and Wilson (1986). The second tradition is based on combining open economy macroeconomics and public economics. One of the firsts formal models of this tradition is presented by Gordon (1986)

On the other hand, the division by Kari and Lönnqvist (2001) cannot take into account some of the new developments in tax competition literature. For example, the tradition tracing back to the model by Mendoza and Tesar (2005) proposes an approach that is based on dynamic general equilibrium models. Although this approach can be seen as a part of the tradition based on international economics and public economics it can also be seen as a separate tradition. This is because these models develop the analysis further and have more complex modeling framework than the earlier models. The division by Kari and Lönnqvist (2001) seems fruitful when added a third school of thought. This category traces back to developments of modern macroeconomic models such as dynamic general equilibrium models, growth models and overlapping generations models[8]. This tradition uses large-scale models to study the dynamics of tax competition. Although there are early models of this kind such as Lejour and Verbon (1997) presented in chapter four this tradition is further developed starting from the 2000s and still seeks it's place in tax competition literature.

This chapter presents the model by Zodrow and Mieszkowski (1986) in detail and considers it as the benchmark of tax competition. The effects of relaxing the key assumptions of the benchmark model are discussed. In addition, workhorse models are presented briefly. These models serve as a starting point for modeling but are not as widely applied as the model by Zodrow and Mieszkowski (1986). The title of this chapter refers to the canonical tax competition model. A discussion about how this thesis views canonicality is provided in the end of this chapter.

[8]For a discussion on the development of modern macroeconomics see Vroey (2016).

3.1 The benchmark model and workhorses

As discussed above this thesis refers to the model by Zodrow and Mieszkowski (1986) as the benchmark model. Their model is presented below. In addition, this subchapter features a discussion about other important frameworks applied in tax competition literature and referred as workhorse models of tax competition.

3.1.1 The benchmark model

The following discussion presents the benchmark model by Zodrow and Mieszkowski (1986). World economy consists of large number of identical countries ($i = 1, ..., N$)[9]. Firms in each country produce a numeraire good using labor and capital as the factors of production. Capital is viewed as physical capital instead of financial capital. This assumption is often used in tax competition literature. It ensures that capital generates real output. Capital stock is fixed at the world economy level such that $\bar{K}$ denotes the aggregate capital stock. Each household supplies one unit of labor. Capital is assumed to be fully mobile between countries whereas labor is immobile. Identical households own labor and sell it to firms.

Firms have access to increasing, strictly concave, twice differentiable and constant returns to scale production technology. Production function is denoted by $F(K_i, L_i)$ where K_i denotes capital stock and L_i denotes labor. Assuming that the production function is homogeneous of degree one and using constant returns to scale properties allows to divide production with labor in order to write production function in per capita terms. Writing the production function in per capita terms yields $y_i = \frac{Y_i}{L_i} = F\left(\frac{K_i}{L_i}, \frac{L_i}{L_i}\right) = F\left(k_i, 1\right) = f\left(k_i\right)$. Production function is applied to produce a numeraire good.

The net profit of a firm is given as the difference between production and wage income, capital income and taxes paid. Wages paid to the employees are denoted by w_i. Capital income paid to the owners of the firm is denoted by rk_i such that the rate of return is r. Countries are assumed to be small in the sense that they cannot affect the world rate of return which, thus, is equal to all countries. Taxes paid to the government are denoted by $t_i k_i$ such that t_i is the capital tax rate. Instead of a pure profit tax in which tax is levied on the difference between revenues and costs this model applies a tax on capital stock. The tax is collected by the government of the country where production happens. This type of taxation is called source-based taxation. The alternative would be to, for example, tax capital in a residence-based system where tax is collected by the government of the home country of a firm.

[9]To be precise, Zodrow and Mieszkowski (1986) consider an economy which consists of large number of identical regions. Later literature has, however, reversed this assumption to concern world economy with large number of identical countries. This is natural when dealing with international corporate tax competiton as in this thesis.

With these definitions the net profits of a firm can be written as

$$f(k_i) - w_i - rk_i - t_i k_i. \tag{1}$$

Using net profits of a firm it can be shown that capital taxation is distorting. In this case distorting tax means that an increase in capital taxation causes an outflow of capital. Differentiating equation (1) with respect to k_i yields the first-order condition of the firm as

$$f'(k_i) - r - t_i = 0, \tag{2}$$

where $f'(k_i)$ is the first derivate of the production function with respect to k_i. Equation (2) gives the net rate of return as $r = f'(k_i) - t_i$. On the other hand, the marginal productivity of capital equals with the marginal cost of capital which can be seen by reorganizing equation (2) as $f'(k_i) = r + t_i$.

Capital is an implicit function of the tax rate in equation (2). Since the net rate of return given by $r = f'(k_i) - t_i$ implicitly defines $k_i = k_i(r + t_i)$ such that $k_i' = 1/f''$. Implicit function theorem could as well be applied to get

$$\frac{\partial k_i}{\partial t_i} = \frac{\partial\left(f'(k_i)\right)/\partial t_i}{\partial\left(f'(k_i)\right)/\partial k_i} = \frac{1}{f''(k_i)} < 0. \tag{3}$$

Implicit differentiation yields an equation that gives the effect of a change in the tax rate to the capital stock of a country. The sign of this equation is negative since by the assumptions of the production function $f''(k_i) < 0$. Equation (3) means that increasing capital tax rate causes an outflow of capital to foreign countries. If one country unilaterally increases it‘s capital tax rate capital outflows to other countries. On the other hand, some country may try to attract capital by lowering it‘s tax rate below the level of other countries. Thus, the capital tax is distorting.

So far the analysis has focused on firm behavior. Governments and citizens are, however, an important part of the model. The government‘s objective is to maximize utility of the representative citizen. Utility of the representative citizen is defined through a strictly quasiconcave and twice differentiable utility function denoted by

$$U(c_i, p_i). \tag{4}$$

The representative citizen derives utility from consumption of private good denoted by c_i and consumption of public good denoted by p_i in equation (4). Consumption of private good can be written as a sum of the net profits of a firm, the wage income paid to the employees and the capital income paid to the owners of the firm. Using the earlier notation consumption can be written as

$$c_i = f(k_i) - w_i - rk_i - t_i k_i + w_i + r\left(\bar{K}/N\right)$$
$$= f(k_i) - rk_i - t_i k_i + r\left(\bar{K}/N\right). \quad (5)$$

The spesification in equation (5) contains the term $r(\bar{K}/N)$ which is the capital income paid to the representative citizen. Since $\bar{K}$ denotes the aggregate capital stock in world level and N denotes the number of countries this term gives the share of the aggregate capital income paid to the representative citizen of each country. On the other hand, public good is financed by the capital tax. This means that public good can be written as

$$p_i = t_i k_i. \quad (6)$$

The government's objective is to maximize utility of the representative citizen. The optimization problem can be written by replacing private consumption and public good consumption in equation (4) with equations (5) and (6). Thus, the optimization problem of a country can be written as

$$\max_{t_i} U\left(f(k_i) - rk_i - t_i k_i + r\left(\bar{K}/N\right), t_i k_i\right). \quad (7)$$

The optimization problem can be solved using total differentiation. Total differentiation is a way to solve the derivative of an equation in spesific cases. In this case total differentiation is applied to solve the derivative of equation (7) with respect to capital tax rate. This can be done by applying a formula given by

$$\frac{\partial U}{\partial t_i} = \frac{\partial U}{\partial c_i}\left(\frac{\partial c_i}{\partial k_i}\frac{\partial k_i}{\partial t_i}\right) + \frac{\partial U}{\partial p_i}\left(\frac{\partial p_i}{\partial k_i}\frac{\partial k_i}{\partial t_i}\right), \quad (8)$$

where the chain rule is applied. This formula gives the derivative of the utility function with respect to the capital tax rate as a sum of the derivatives of the utility function with respect to private consumption and public good consumption multiplied with the indirect depencies. Applying the formula of equation (8) to equation (7) yields

$$\frac{\partial U}{\partial c_i}\left(f(k_i) - rk_i - t_i k_i + r\left(\bar{K}/N\right), t_i k_i\right) * \left(f'(k_i)\frac{\partial k_i}{\partial t_i} - k_i - (r + t_i)\frac{\partial k_i}{\partial t_i}\right) +$$

$$\frac{\partial U}{\partial p_i}\left(f(k_i) - rk_i - t_i k_i + r\left(\bar{K}/N\right), t_i k_i\right) * \left(k_i + t_i\frac{\partial k_i}{\partial t_i}\right) = 0. \quad (9)$$

Equation (9) can be rewritten in simpler manner. This is done denoting $\frac{\partial U}{\partial c_i} = U_c$ and $\frac{\partial U}{\partial p_i} = U_p$, moving the first term of the equation (9) on the right-hand side and dividing both sides with $\frac{\partial U}{\partial c_i}\left(f(k_i) - rk_i - t_i k_i + r\left(\bar{K}/N\right), t_i k_i\right)$ and $\left(k_i + t_i\frac{\partial k_i}{\partial t_i}\right)$. Rewriting equation (9) yields

$$\frac{U_p}{U_c} = -\frac{\left(f'(k_i)\frac{\partial k_i}{\partial t_i} - k_i - (r+t_i)\frac{\partial k_i}{\partial t_i}\right)}{\left(k_i + t_i\frac{\partial k_i}{\partial t_i}\right)}. \tag{10}$$

Recalling that according to equation (2) $r = f'(k_i) - t_i$ equation (10) can be rewritten as

$$\frac{U_p}{U_c} = -\frac{\left(f'(k_i)\frac{\partial k_i}{\partial t_i} - k_i - f'(k_i)\frac{\partial k_i}{\partial t_i} - t_i\frac{\partial k_i}{\partial t_i} + t_i\frac{\partial k_i}{\partial t_i}\right)}{\left(k_i + t_i\frac{\partial k_i}{\partial t_i}\right)},$$

which reduces to

$$\frac{U_p}{U_c} = \frac{k_i}{k_i + t_i\frac{\partial k_i}{\partial t_i}}. \tag{11}$$

In order to simplify equation (11) further the right hand side of the equation can be divided by k_i and the fact that according to equation (7) $\frac{\partial k_i}{\partial t_i} = \frac{1}{f''(k_i)}$ can be recalled. After these steps equation (11) simplifies to

$$\frac{U_p}{U_c} = \frac{1}{1 + \frac{t_i}{k_i f''(k_i)}}. \tag{12}$$

Pareto efficient production of public goods is an influential result in public economics. Samuelson (1954) argues that public goods are Pareto efficiently produced if the marginal rate of substitution and the marginal rate of transformation are equal. In Zodrow and Mieszkowski (1986) framework public good production is Pareto efficient if $\frac{U_p}{U_c} = 1$. The condition for Pareto efficient public good production does not realize in equation (12). The capital tax rate and the capital stock are both assumed to be positive. In addition, it was derived that $\frac{1}{f''(k_i)}$ is negative. This means that the denominator of equation (12) is smaller than one. This implies that equation (12) is greater than one. The condition for Pareto efficient public good production does not hold and public good production is inefficient. The production possibility frontier of a country shifts inward if it has to rely on capital tax only and, thus, cause inefficiencies.

Thus, public goods are underprovided. This results originates from the fact that due to tax competition capital tax rates are too low. In the benchmark model countries behave in a Nash manner. This means that countries choose capital tax rate as an optimal response i.e. the one that provides the maximum welfare. Following earlier analysis the Nash equilibrium capital tax rate of a country can be defined as $\widetilde{t}$ that satisfies $\widetilde{t} = \arg\max_{t_i} U(c_i, p_i)$.

Reviewing the lessons of the benchmark model of tax competition by Zodrow and Mieszkowski (1986) reveals two key results. Firstly, the presence of tax competition implies that an unilateral increase in the capital tax rate of a country results in an outflow of capital to foreign countries. Full international mobility of capital is a key assumption behind this results. Wildasin (1989) argues that this dynamic of tax

competition can be seen as an externality. Increasing the capital tax rate shows the discrepancy between the perceived and true social marginal cost of public spending. The tax revenues of other countries increase due to the inflow of capital and this means that the discrepancy and the induced change in tax revenue are equal.

Secondly, tax competition implies underprovision of public goods in Samuelson's (1954) sense. Since public goods are financed only through distortionary capital tax governments set too low tax rates. Tax competition may lead to a race to the bottom. Countries may compete by lowering their capital tax rates and drive them to zero. Rota-Graziosi (2019) emphasizes the role of two properties of tax competition game especially. First, there is the positive tax spillover which means that if one country lowers it's tax rate the payoff of other countries reduces. The opposite is true if one country increases it's tax rate. The second property is that tax rates are strategic complements. This means that tax rates of different countries enforce each others. The property confirms that with any change in tax rates other countries will respond with similar actions.

The benchmark model consists of many identical countries. This means that the model is modeling small open economics. Devereux and Loretz (2013) argue that the assumption of many identical small countries is, in addition to full mobility of capital, the key assumption of the model. They propose that due to this assumption it is sure that the decreasing returns to capital affect the reallocation. The implications of relaxing the key assumptions are reviewed later in this thesis.

3.1.2 Workhorse models

The benchmark model of tax competition may be the most important tax competition model. It serves as a starting point to many later models. On the other hand, some argue that the canonical tax competition model is based on the models by Zodrow and Mieszkowski (1986) and Wilson (1986). Keen and Konrad (2013) even present a synthesis of these models. Wilson (1986) provides important insights to labor and capital intensivity issues which are not present on the benchmark model. Therefore, Wilson's (1986) model is briefly discussed as a workhorse model of tax competition.

These two models are based on microeconomic framework with firm optimization and governments maximizing utility of the representative citizen. Tax competition literature includes workhorse models with different methodology. Gordon's (1986) model serves as a starting point for many tax competition models from international economics tradition. Mendoza and Tesar's (2005) model serves as a starting point for many tax competition models from dynamic macroeconomics tradition.

The model by Wilson (1986) is built on world economy with large number of identical countries. Firms in each country have access to production technology

that uses capital and labor as factors of production. Both factors are fixed in world economy level. Capital is mobile while labor is immobile. The rate of return for capital is equal between countries. Identical households own labor. This model departs from the benchmark model by presenting three sectors. Each country has a national good industry denoted by subscript N, a local good industry denoted by subscript LG and public service denoted by subscript P. National good is a numeraire good traded in exchange for capital but local good and public service are only locally consumed.

The objective of the government is to maximize utility of the representative citizen. Utility of the representative citizen is presented by a utility function that is weakly separable between consumption of private goods and public service. The demand of the representative citizen for good of sector i is denoted by D_i. Private utility is given by a function homogeneous of degree one denoted by $V(.)$. With these notations utility of the representative citizen can be written as

$$U(V(D_N, D_{LG}), D_P). \tag{13}$$

Utility given by equation (13) is maximized with respect to the budget constraint. The endowment of capital of the representative citizen is denoted by $\overline{K}$ and the endowment of labor is denoted by $\overline{L}$. In addition, ρ denotes the after tax return to capital. The budget constrain can be written as

$$D_N + pD_{LG} = \rho\overline{K} + w\overline{L}. \tag{14}$$

Equation (14) states that the demand for private good should be equal to the disposable income of the representative citizen.

The optimal policy solves the optimization problem above. The key insight this model provides is to describe the prerequisites of tax competition. From a country‘s viewpoint an increase in investment due to lower capital tax rate is a benefit associated with lower level of public service output denoted by X_P. In world level the capital stock is fixed. This implies that in foreign countries there is an outflow of capital which equals the inflow of capital to this country. Governments ignore this effect because they aim to improve the utility of their citizens. However, the world level of utility is lower than it would be if every country acts this way. The equilibrium capital stock of a country is denoted by $K(\rho, X_p)$. The capital stock is a function of the after tax return to capital and the public service output. It can be stated that tax competition exists if and only if $\frac{\partial K(\rho, X_p)}{\partial X_p} < 0$. This result formally states that an increase in the public service output causes an outflow of capital. This is a similar condition to that of the benchmark model given by equation (3) although the focus is on the public service output instead of the capital tax rate.

The sign of the derivative of the equilibrium capital stock can be decomposed to the output effect and the factor substitution effect. The output effect is studied by considering a situation in which the public service is increased but utility of the representative citizen is kept constant by reducing the lump sum income. Tax rate and prices faced by the firms are kept constant. Since prices are constant the capital-labor ratios of national and local good production remain constant. In addition, capital-labor ratio is the same for public service production. This can be seen from a term called public shadow price. This term is denoted by s_i and presents the social cost of employing an addititional unit of factor i in production of public service. Because policy is initially optimal it holds for public service production that $\frac{s_K}{s_L} = MRS_{KL}$, where MRS_{KL} denotes the marginal rate of substitution between capital and labor. Constancy of prices means that the ratio of national and local good is the same as before. Thus, the public service output can be increased only by transferring labor from private good production to public service production. The capital stock of a country requires a fall to complete this transfer without changing the capital-labor ratios or the private consumption pattern if public service production is labor intensive. If, on the other hand, it is capital intensive the capital stock requires a rise. Therefore if can be stated that the output effect is negative if

$$\lambda_{LP} = \frac{L_P}{L} > \lambda_{KP} = \frac{K_p}{K}$$

and positive if

$$\lambda_{LP} =< \lambda_{KP}.$$

The substitution effect is studied by increasing public service production and letting the capital tax rate and prices adjust. In order to finance increased public service production the capital tax rate must increase. This changes the shadow price ratio and, thus, capital-labor ratios. This implies that the relative price of more capital intensive private good increases and changes the consumption pattern towards more labor intensive private good. In order to clear the private capital market the capital stock must fall as a result from production and consumption becoming more labor intensive. This implies that the factor substitution effect is always negative.

These results show that tax competition may or may not exist. If both of the effects are negative tax competition exists. This is the case when public good production is labor intense. On the other, hand capital intensivity of public good production implies that these effects have different signs and tax competition does not exist. This result means that a reduction in the public service level of every country causes an increase in utility. If tax competition exists an increase in the capital tax rate changes both demand and supply to labor intensive goods and production

techniques of private firms to be more labor intensive.

The models presented so far study tax competition from microeconomic perspective and stem from the fiscal federalism tradition. The second major tradition in tax competition literature is based on models that stem from international macroeconomics and public economics. This literature strand does not have as clear benchmark model. However, the model presented by Gordon (1986) can be seen as one of the most important early works of this strand as Kari and Lönnqvist (2001) argue.

The model by Gordon (1986) studies international capital flows and the optimal tax policy of small open economies using a general equilibrium framework. The starting point is different from that of the earlier models. Unlike the earlier models Gordon (1986) applies a two-period framework in which each small open economy contains a representative citizen and one freely tradeable good. In the first period the representative citizen is given a wealth endowment denoted by Y_j which she can spent on the first period consumption denoted by C_{j1} or invest. The net-of-tax return on investment is denoted by q_j. Government produces public service denoted by G_j in the first period and finances them by debt. Debt is paid from the tax revenue in the second period. The representative citizen works L_j hours in the second period and earns a before-tax wage denoted by w_j. Labor income is taxed with a rate denoted by s_j.

Production happens only in the second period when firms produce using production technology described by $f(K_j, L_j)$ with $f_K > 0$ *and* $f_{KK} < 0$. Corporate income is taxed corporate income tax denoted by τ_j. Therefore, the after tax profit can be written as

$$(1 - \tau_j)(f(K_j, L_j) - w_j L_j) + K_j.$$

Representative citizen maximizes utility which is a function of consumption of both periods, disutility of labor and utility from public service. The utility can formally be written as

$$U(C_{j1}, C_{j2}, L_j) + U^*(G_j). \tag{15}$$

Equation (15) is maximized subject to the budget constraint following the descriptions above and given as

$$C_{j2} = (1 - s_j) w_j L_j + (1 + q_j)(Y_j - C_{j1}). \tag{16}$$

The government, however, chooses the optimal policy by maximizing the representative citizen‘s utility subject to the aggregate resource constrant given as

$$C_2 + (1 + i(\pi)) G + (1 + p^c) K$$

$$\leq f(K, L) + K + (Y - C_1)(1 + p(t)), \tag{17}$$

where $i(\pi)$ is the domestic inflation rate, $p(t)$ is the return from the best available asset, p^c is the cost of finance for domestic corporations given the means of finance they choose. Government chooses the values for w^n, t, g, K, π and allows G to adjust. Solving the optimization problem yields that the optimal corporate tax rate is zero. This is because labor taxation is available and capital supply from abroad is infinitely elastic. This means that labor bears all the tax burden. In addition, the labor income tax dominates the corporate tax because the corporate tax reduces capital investment causing an additional distortion. Whereas the earlier models apply a more general capital taxation Gordon (1986) applies capital taxation that is spesificly corporate income taxation.

The third strand of tax competition literature applies modern macroeconomics models. This strand has many issues in common with the tradition that stems from international economics and public economics. However, this strand has an own workhorse model. The model by Mendoza and Tesar (2005) is a neoclassical growth model. The model is calibrated to European data. The strand of literature that stems from modern macroeconomics brings a new feature to tax competition theory since it includes calibration of the models as a part of the analysis.

This model builds on a two-country framework in which governments are allowed to meet once to play a tax competition game. In this game they choose the time-invariant tax rate on capital. There is a payoff for each country for each tax strategy. The payoff corresponds to the welfare gain or the welfare loss that each country makes at competitive equilibrium to satisfy the government constraints. Three externalities are presented in order to illustrate the features of tax competition. The relative price externality states that countries attempt to affect the terms of trade or the interest rate via tax policy. The wealth-redistribution externality is such that taxation affects the accumulation of the factors of production. The tax cuts can, thus, be a means to attract mobile factors. The fiscal solvency externality is a result of the two mentioned ones.

The utility of representative household is given by an isoelastic lifetime utility function as

$$U(c_t, l_t) = \sum_{t=0}^{\infty} \left[\beta (1-\gamma)^{1-\sigma}\right]^t \left(\frac{(c_t l_t^a)^{1-\sigma}}{1-\sigma}\right), \tag{18}$$

where subscribt t denotes time index, c_t is consumption, l_t is leisure, β is household's subjective discount factor ($0 < \beta < 1$), $\frac{1}{\sigma}$ is the intertemporal elasticity of substitution in consumption ($\sigma > 1$) and a governs the intertemporal elasticity of labor supply for a given value of σ ($a > 0$). The sequence of periodic budget constrains is

given as

$$(1+\tau_C)\,c_t + (1+\gamma)\,(k_{t+1} + q_t b_{t+1} + q_t^g d_{t+1}) + \left(\frac{\eta}{2}\left(\frac{x_t}{k_t} - z\right)^2 - 1\right) k_t$$

$$= (1-\tau_L)\,w_t L_t + (1-\tau_K)\,(r_t - \delta)\,k_t + b_t + d_t + e_t, \tag{19}$$

where τ_C denotes the consumption tax, $\tau_L$denotes the labor income tax, τ_K denotes the capital income tax, b_t denotes the private international bonds, d_t denotes the domestic government bonds, δ denotes the rate of depreciation of the capital stock, x_t denotes net invetments, w_t denotes the labor wage rate, r_t denotes the capital factor payment rate, $q_t^g$and q_t denote the prices for the government bonds and the private bonds respectively, η determines the speed of adjustment of capital stock and z is the long run investment-capital ratio. There is also no-Ponzi condition[10]. Firms have access to Cobb-Douglas production tehcnology and the government budget constraint is given as

$$(g_t + e_t) = \tau_C c_t + \tau_L w_t L_t + \tau_K\,(r_t - \delta)\,k_t + (1+\gamma)\,q_t^g d_{t+1}. \tag{20}$$

This model builds a more complex model economy than the models mentioned earlier. Mendoza and Tesar (2005) calibrate the model for European data and are able to derive tax rates that are similar to the ones observed. They argue that the tax rates observed are a result of tax competition in which tax revenue externality triggers changes in labor taxation. Thus, the changes tax competition causes are adjusted by labor taxation. If, however, consumption taxes are assumed to be adjusting race to the bottom would occur. This would benefit the countries since distorting capital taxation would be replaced with consumption taxes.

3.2 Relaxing the key assumptions of the benchmark model

The benchmark model as well as workhorse models use several assumptions. Devereux and Loretz (2013) argue that full mobility of capital and symmetricality of countries are the key assumptions of the benchmark model. In addition, one especially important assumption is that in the benchmark model public goods are financed through capital taxation only. The benchmark model implicitly assumes that all industries have the same tax treatment. In addition, the benchmark model does not identify the nature of public goods.

There are many assumptions that may affect the implications of tax competition. This subchapter studies the implications of relaxing the key assumptions of the benchmark model. Most of the presented models use the benchmark model as

[10]The no-Ponzi condition is common in modern macroeconomics models. It restricts the agents from paying debt with new higher debt forever.

their starting point but some models use different strategy. This is because some institutional layers may be hard to introduce to the framework of the benchmark model.

3.2.1 Imperfect mobility of capital

One of the key assumption of the canonical tax competition model is that capital is fully mobile between countries. This assumption, however, is not fully in line with international capital movements. Mobility of capital has increased but capital movements are costly since, for example, there are transaction costs. The role of imperfect mobility of capital in tax competition is studied by Lee (1997) who applies a two-period two-country framework building on the benchmark model.

This model assumes that capital is fully mobile in the first period but a transaction cost is required in the second period if capital is moved between regions. Usually the net return on capital equals the marginal product minus the tax rate such that in equilibrium equation (2) holds. Since transaction costs are required in the second period capital must have higher return in the jurisdiction it relocates in. Otherwise, there would be no incentive to relocate. This implies that capital can only move from one country to another but not from both countries. The jurisdiction that serves as the destination for the relocation of capital must pay higher return to it. Thus, capital moves only when a critical value of transaction cost is crossed.

If transaction costs are greater than the critical values capital will not move. This implies that tax competition is even more aggressive in the first period but that in the second period there is overprovision of public goods. Tax competition becomes even more aggressive because capital only moves during the first period. On the other hand, since capital does not move in the second period countries can set even too high tax rates.On the other hand, the results differ if transaction costs are smaller than the critical values. In this case capital moves in both periods and underprovision of public goods may result.

3.2.2 Asymmetric countries

In the benchmark model countries are identical. However, countries differ with respect to their population, for example. Bucovetsky (1991) presents a two-country tax competition model in which countries differ in population size. The model is based on the benchmark model. However, this model assumes only two countries such that the share of country i's population of the world population is denoted with s_i. The first country is assumed to have a greater or equal share of the world population than the second country such that $s_1 \geq s_2$. When the number of jurisdictions is small the net return on capital given by equation (2) is affected by changes in public goods provision. If one of the countries chooses to increase public

good provision the net return to capital decreases. However, citizens have a positive supply for it.

The underprovision incentive is especially strong if the country is a net exporter of capital. This effect is not present if countries are small in the sense that they cannot affect the world net return to capital. Another interesting feature of this model is that it is shown that smaller country sets lower tax rates. This result is obtained assuming quadratic production function defined as $f(k_i) = (a - bk_i)\,k_i$, where a and b are parameters. In addition, it is proved that with this equilibrium citizen's of the smaller country have higher utility than those in the bigger country. The dynamic behind this result is that the revenue effects are more critical for the smaller country and, thus, it favors to set lower tax rate.

Another tax competition model with asymmetric countries is provided by Wilson (1991). In this two-country model governments can buy one unit of private good and turn it into one unit public good. The maximization problem implies a condition in which public goods are underprovided if tax rates satify $t_1 > t_2$. On the other hand, they result in a proposition where $u_1 \gtrless u_2 \; as \; t_1 \lesseqgtr t_2$. This model, thus, provides more general conditions under which smaller countries set lower tax rates and have higher utility.

A more recent model of asymmetrical countries is provided by Pieretti and Skerdilajda (2011). This model includes two countries with different sized populations. Public goods are seen in a broad manner including, for example, infrastructure and services. Public goods may, thus, enhance the productivity of firms. Therefore, firms are also attracted by public goods and they the make location decisions based on both the tax rate differentials and public goods levels. Tax competition is modeled through a game in which governments first choose the level of public good and then set tax rate to maximize their rents. Mobility costs of firms are in a key role for the results. If mobility costs are very low larger country can only attract capital by offering higher levels of public goods than the smaller country. On the other hand, with intermediate mobility costs the smaller country can attract firms with high public good supply but without lowering it's tax rate.

The result that smaller countries set lower tax rates is questioned by Lai (2014) who introduces lobbying to asymmetric tax competition framework. Citizens are divided to capitalists and workers. It is assumed that capitalist build a lobbying organization to affect the tax rate. In this model labor taxation is present and the lobbying organization is able to shift most of the tax burden to workers. This means that there is less pressure to decrease the capital tax rate. This only holds for the smaller country because it is assumed to be a small open economy which cannot effect the net rate of return on capital. Capitalist adjust to higher tax rate. They can use domestic public goods but the true tax burden is shifted to workers.

The nature of tax competition between developed and developing countries is also studied. Mardan and Stimmelmayer (2020) present a model in which countries difffer with respect to country spesific risk. Based on a two-country framework with a multinational corporation they argue that profit shifting possibilities of the multinational corporations crucially affect the optimal tax rates of the two countries. Their results suggest that compared to lower-risk countries higher-risk countries may set lower tax rate if profit shifting is costly and higher tax rate if profit shifting is less costly. Thus, tax competition works differently for developed and developing countries. In developing countries governments do not have efficient tools to limit profit shifting and tax rates are set higher. On the other hand, with low costs of profit shifting governments of the developed countries must respond via lower tax rates since otherwise profit shifting increases.

3.2.3 Role of the government‘s budget in tax competition

Public goods are not speficly defined in the benchmark model. Public goods can be, for example, transfers or infrastructure investment. Infrastructure investment can be thought as an example of a case in which public inputs are applied to produce private good. When governments provide infrastructure firms use it as part of their production. The benchmark model is extended to study public inputs by writing production function as $f(k_i, b_i)$, where b_i is the level of public goods that is provided to firms. The government budget constraint is written as $t_i k_i = p_i + b_i$, where p_i is public goods other than those provided to firms. Solving the optimization problem using similar steps than in chapter 3.1.1 implies that public goods are underprovided. The fact that firms use public good as a part of their production does not change the dynamics of the model.

The composition of government‘s budget is further studied by Keen and Marchand (1997). Again, public goods are used as an input in private production. The production function in their model is defined as $f(k_i, l_i, b_i)$, where the output comes from a process using capital denoted by k_i, labour denoted by l_i and public input denoted by b_i. This model departs from the benchmark model by modeling labor in a different manner. Wage tax denoted by τ_i is set as is capital tax denoted by t_i . With these definitions the private budget constraint can be written as

$$c_i = (w_i - \tau_i) l_i + (1 - t_i) R + p\bar{k}, \tag{21}$$

where w_i is the wage rate, l_i is the labor supply, R is return to capital and $\bar{k}$ is the world capital stock. Both rents and capital are taxed in this model. Capital tax is denoted by T. The government constraint can be written as

$$p_i + b_i = \tau_i l_i + Tk + tR. \tag{22}$$

Equations (21) and (22) can be plugged in the utility function defined as

$$U\left(c_i - a(l_i), p_i\right),$$

where $a\left(.\right)$ is the real disutility related to labor supply l_i and p_i is public good provision.

Solving the optimization problem as earlier yields that public goods are underprovided. However, the contribution of this model is to show that tax competition causes inefficiences to the composition of public goods. Public inputs may end up relatively overprovided and consumption related items may end up underprovided. Because firms use public goods in their production governments may try to attract firms by overproviding public inputs. Other parts of the budget may, therefore, end up relatively underprovided.

In addition to budget composition the role of the budget can be modeled through spillovers. Certain government policies such as climate protection may have spillover effects. This means that the effect of a policy spills to other countries. Bjorvatn and Schjelderup (2002) present a model that includes spillovers. Their idea is to include spillover effects to the utility function as a part of the public good consumption. The basic model stems from the benchmark model. They present the public good consumption as $p_i = p_i + \beta \sum_{ji} p_j$, where p_i denotes the domestic public good consumption and the second term is the spillover effects. Spefically $\beta \in [0, 1]$ measures how does the public good consumption in region j spillovers to region i. With the spesification in which $\beta = 0$ there are no spillovers. With the spesification in which $\beta = 1$ there are perfect spillovers. In practise the no spillovers case means purely national public good and the perfect spillovers case means purely international public good. Solving the optimization problem yields that public goods are underprovided for imperfect spillovers. For perfect spillovers, however, public goods are optimally provided. With full spillovers the gain of attracting capital is offset by the international loss of public goods.

3.2.4 Broadening the financing base of public goods

Public goods are financed by capital tax in the benchmark model. Later research broadens the financing base of public goods. Bucovetsky and Wilson (1991) present tax competition model with income tax. This model builds on two-period framework in which governments choose the tax rate they commit to in the first period. Production happens in the second period when individuals decide how much labor to supply and how much to save. Tax collection and public good production happen

in the second period. Optimization problem can be written as

$$\max_{c_1,c_2,n} U\left(v(c_1,c_2,l),p\right) \ s.t.$$

$$c_2 = (1+p)(e-c_1) + wl.$$

Utility builds on the private utility function $v(c_1, c_2, l)$, where there is the first and the second period consumption and labor supply in the second period. In addition, public good consumption is on the utility function. The budget constraint states that the second period consumption should equal the wage income and the income from the endowment. In the budget constraint p is the after-tax domestic interest rate, w is the after-tax wage rate and e is the initial resource endowment. In addition taxes are defined as $t = r - R$ and $T = w - \omega$. The first equation states that the source-based capital tax rate is the wedge between the cost of capital on return on capital. The second equation states that wage tax is the wedge between product of labor and wage rate.

The government‘s problem is to maximize utility of the representative citizen. Public good consumption and taxes are the constraints. This model implies that both wage income tax and capital tax rates are positivive. However, public goods are still underprovided. In addition, tax rates of capital relative to labor are inefficiently low. It is argued that underprovision in this scenario results because there is no residence-based taxation available. As usual it is assumed that only source-based taxation is available. However, the lack of residence-based taxation causes the outflow effect of capital in this model.

Tax competition models often consider a situation in which capital or corporate tax rate is the only tax instrument. Studying the structure of corporate tax systems reveals that tax base is also an important tax instrument when considering the total corporate tax burden. Devereux et al. (2002) show that although the statutory corporate tax rates have declined starting from the 1980s the effective tax rates have not declined as rapidly since corporate tax base has been widened. Haufler and Schelderup (2000) consider a situation in which government can choose both the corporate income tax rate and the tax base.

This model builds on a two-country and two-period framework. Firms use capital as the only factor of production and have access to production technology described by a production function $f(k_i)$. The user cost of capital is denoted by rk_i and capital depreciation is denoted by δk_i. With this notation the gross profits in each country are defined as

$$f(k_i) - (r+\delta)\, k_i. \tag{23}$$

Equation (23) can be rewritten allowing tax deductibility parameter to enter. Tax deductibility parameter is denoted by α_i. It can vary across countries. The corporate

tax base in a country can be written as

$$f(k_i) - \alpha_i (r + \delta) k_i. \tag{24}$$

This definition has interesting implications. If $\alpha_i < 1$ government also taxies investments. If $\alpha_i = 1$ government only taxes pure profits. This is the definition in use in many tax competition model. If $\alpha_i > 1$ government subsidies investments.

Applying equations (23) and (24) and denoting the tax rate by t_i the net after-tax profits can be written as

$$\pi_i = f(k_i) - (r + \delta) k_i - t_i [f(k_i) - \alpha_i (r + \delta) k_i]$$

$$= (1 - t_i)(f(k_i) - (r + \delta) k_i) - (1 - \alpha_i) t_i (r + \delta) k_i. \tag{25}$$

The optimization problem of an individual is to maximize utility subject to the intertemporal budget constraint. Each individual receives an exogenous endowment denoted by e_i in the first period. She can either consume or invest it. Savings are denoted as $(c_i^1 - e_i)$. The entrepreneur in country i owns a share of a firm denoted by s_i in both countries. Since investment earn return denoted by r we can write the intertemporal budget constraint of a citizen in country as

$$c_i^2 = s_i \pi_i + (1 + r)\left(e_i - c_i^1\right). \tag{26}$$

This model departs from the canonical tax competition model in multiple levels one of which is that a fixed revenue requirement is presented. This means that when choosing the right tax rate and the tax base or the tax system denoted by (t_i, α_i) government has to collect an exogenously given amount of tax revenue $R_i > 0$ through corporate taxation. This constraint can be seen as a political constraint. Government maximizes indirect utility function denoted by $V_i(t_i, \alpha_i)$ subject to revenue requirement. Government‘s problem can, thus, be written as

$$\mathcal{L} = V_i(t_i, \alpha_i) + \mu_i [t_i T_i - R_i]. \tag{27}$$

Solving the optimization problem shows that with no foreign direct investment it is optimal to allow full deduction of investment expenditure. This does not disturb the investment behavior of the firms. In addition, it is optimal to set tax rate such that the revenue satisfies the budget. When foreign direct investment is introduced it becomes optimal not to allow full deduction of investment expenditures and, in turn, lower the corporate tax rates to reduce profit shifting. This mechanism helps to correct the distortion caused by corporate taxation. Disturbing the investment behavior allows to set lower level of corporate taxation and reduces profit shifting.

Many tax competition models assume that public sector is financed through tax revenue only. Jensen and Toma (1991) extend this assumption by allowing debt to be a financing mechanism. They build two-country and two-period model in which public spending is financed through tax revenue of the current period and debt. Model economy has the representative citizen and a homogeneous numeraire private good is produced via production function given by $f(k_{it})$ where $i = 1, 2$ denotes country and $t = 1, 2$ denotes time period.

Government financing differs in periods one and two. In the first period government is financed through tax revenue collected in the first period and government bonds denoted with d_i. In the second period tax revenue is collected and governments must pay back the debt. Governments must pay an interest denoted by r^* from the debt. With this notation the government budget constraints for the two periods can be written as

$$\begin{aligned} p_{i1} &= t_{i1}k_{i1} + d_i \\ pg &= t_{i2}k_{i2} - (1 + r^*)\, d_i. \end{aligned} \tag{28}$$

Utility function can be written as

$$U_i(x_{it}, p_{it}) = U(x_{it} + h(p_{it})),$$

where x_{it} is the private consumption. For private consumption there are also two budget constraints. In addition, $h'(0) > 1$, $h' > 0$ and $h'' < 0$. In the first period private consumption is the net income less the purchases of governments bonds denoted by s_i. In the second period private consumption is the net income plus income from the government bonds. The net income is the factor income plus the capital income. The share of capital in jurisdiction i is denoted by θ_i. With these notations the net income and the budget constraints for the two periods can be written as

$$\begin{aligned} y_{it} &= f_i(k_{it}) - f_i'(k_{it})\, k_{it} + \theta_i p_t K, \\ x_{i1} &= y_{i1} - s_i, \\ x_{i2} &= y_{i2} + (1 + r)\, s_i. \end{aligned} \tag{29}$$

The optimization problem follows the canonical tax competition literature by assuming that governments maximize utility of the representative citizen. This is done by choosing the tax rate and the level of debt in the first period and the tax rate in the second period. Government spending is assumed to adjust to the chosen tax rate and debt level. Total utility can, thus, be written as sum of utilities of the two periods and can be witten as

$$W_i = U_i(y_{i1} - s_i, t_{i1}k_{i1} + d_i) + U_i(y_{i2} + (1 + r^*)\, s_i, t_{i2}k_{i2} - (1 + r)\, d_i). \tag{30}$$

Optimization problem is solved by considering first the second period problem and then the first period problem. The insteresting results of his model imply that governments do not choose to balance periodic budgets when issuing debt is available. This brokens the connection between tax rates and public good provision. This is because in this model high taxes do not mean higher level of public goods. Paying the debt in the second period means that the second period tax rate is high. At the same time public good provision is low because debt has to be paid.

3.2.5 Preferential treatment

In the benchmark model all asset types and industries face the same tax treatment. Governments may, however, try to attract certain kind of firms by allowing them different tax treatment. Janeba and Smart (2001) note that preferential treatment can occur in multiple ways. In addition to allowing different corporate tax rate to different firms or industries governments may allow selective investment tax credits or tax holidays to some firms.

Janeba and Smart (2001) study the implications of preferential treatment in a two-country and two tax base model. Instead of competing over one tax base countries compete over two. Governments have different objectives than in the benchmark model. Instead of utility maximization it is assumed that home and foreign country both have two tax bases and governments maximize the joint tax revenue[11]. The effects of preferential treatment on tax revenue play an important part in this model.

Analysis starts from a situation in which the two governments agree to restrict the preferential treatment regimes. The effect of restriction can be decomposed to the base effect and the strategic effect. Posing restrictions on preferential treatment increases tax revenues through the base effect. Strategic effect presents the impact on the intensity of tax competition. Whether total tax revenue falls or increases after posing a restriction depends on the relative magnitude of these effects. The results suggest that restricting preferential treatment may in some cases be desirable. Restricting preferential treatment is desirable if the tax base with lower tax rate is more mobile than the tax base with higher rate. It may even be that if the bases respond to changes in a similar way restriction cause an increase in tax revenue. However, if the bases do not respond to changes restriction reduces tax revenues. The key driver behind these results is the elasticity of tax base with respect to a coordinated tax changes.

A more positive view on preferential treatment is provided by Keen (2001) who argues that preferential treatment may make tax competition less harmful. In this

[11]This type of goverment is know as Leviathan goverment. Description of Leviathan governments and tax competition can be found from chapter 4.6.

two-country two tax base model governments are assumed to maximize tax revenue. The implications of preferential treatment are studied by solving the Nash equilibrium tax rates and revenues of unconstrained and constrained regimes and comparing them. It is shown that the tax revenue decreases if countries are prevented from offering preferential treatment. Allowing preferential treatment means that countries can restrict tax competition to concern only a part of the tax system. Without preferential treatment countries would compete with all tax system.

Bucovetsky and Haufler (2007) extend the analysis of Keen (2001) by adding asymmetries between countries to the model. The populations are different sized in the countries. The share of the country i population of the total population is denoted by s^i. It is assumed $s^A \leq 0.5$ and $s^B \geq 0.5$. The implications are similar to the ones above although asymmetry is presented. Not allowing preferential treatment will lower the average tax rate. This means that tax competition becomes more aggressive than it would with preferential treatment. If governments are prevented to compete through spesific tax bases they will compete through the overall level of taxation.

3.3 Discussion on the canonical tax competition model

The focus on this chapter is mostly on the benchmark model of tax competition. The model by Zodrow and Mieszkowski (1986) is fruitful in analysis and widely applied in later literature. It is shown that tax competition leads to underprovision of public goods. Competitive pressures drive tax rates to inefficiently low levels and public goods are not efficiently produced. In addition, it is shown that this result is strong. Underprovision result often holds although the key assumptions are relaxed.

According to the benchmark model it is possible that tax competition causes race to the bottom. This means that tax competition drives tax rates to zero. However, although the corporate tax rates have declined they are far from zero as are the corporate tax revenues (Devereux et al. 2002; OECD 2019). It is possible that there is no race to the bottom. Many issues may explain this trend. It may be that tax bases have been broadened (Loretz and Notes 2008), economic activity has risen (Huber et al. 2020) or that the distribution between labor and capital income has changed for capital.

On the other hand, it is possible that race to the bottom takes more time than thought. Corporate tax rates have lowered also in the 2000s. This development can be seen as a sign that race to the bottom is happening all the time. However, the convergence of corporate tax rates to zero or near zero may take several decades or longer. Tax competition started at mid 1900s or at latest in the 1980s so it is a relatively new phenomenon. Therefore, it is natural that tax rates are still above zero although race to the bottom would occur.

The workhorse models of tax competition provide important insights to the dynamics of tax competition. Wilson (1986) argues that tax competition exists if public service production is labor intense. In this case an increase in capital tax rates changes both demand and supply to labor intensive goods as well as production techniques to more labor intense one. Gordon (1986) argues that the optimal capital tax rate is zero. Mendoza and Tesar (2005) are able to build a model that yields corporate tax rates similar to those actually observed.

The implications of these models are quite different. One argues that corporate tax rate should be zero whereas the other derives positive tax rates. The benchmark model implies that there may be race to the bottom. The modelling methodologies differ as well do the research questions. These may explain at least part of the differences. On the other hand, although these implications differ quantitatively they are similar qualitatively. All models include an idea of tax competition which reduces tax rates or an idea that tax rates should decrease.

The title of this chapter is the canonical tax competition model. Earlier discussion does not, however, define what canonical means. Instead Zodrow and Mieszkowski‘s (1986) model is referred as the benchmark model and other presented models are called workhorse models. In this context canonical means an abstraction of the benchmark and workhorse models. All these models are important part of theories of tax competition. Because tradition of tax competition is wide canonicality cannot be presented by a single model. The canonical tax competition model is, in fact, more an idea than a model.

This view of canonicality differs from the earlier literature. Often in tax competition literature the canonical tax competition model is used to describe Zodrow and Mieszkowski‘s (1986) and Wilson‘s (1986) models or a synthesis of them. This view is problematic for two reasons. Firstly, later models often only use Zodrow and Mieszkowski‘s (1986) model as a starting point. Therefore, if canonicality refers to an actual model it should refer only to the model by Zodrow and Mieszkowski (1986).

Secondly, the definition in which canonicality refers only to the models mentioned above cannot take into account the diversity of theories of tax competition. Although microeconomic modelling approach is very important in tax competition literature there are important macroeconomic modelling traditions. These traditions and their division are briefly discussed in this chapter. The division between traditions is based on views from the history of economic thought of tax competition.

Because earlier definition of the canonical tax competition model cannot reach these issues this thesis proposes a new definition for canonicality. Instead of viewing canonicality in a way in which it refers to the models by Zodrow and Mieszkowski (1986) and Wilson (1986) it should be viewed referring to the ideas of theories of

tax competition presented by different traditions. In this definition canonicality is presented through the history of economic thought of tax competition and the most important models of these strands.

It is acknowledged that the definition based on the history of ideas leaves the canonical tax competition model hard to reach. Defining the canonical tax competition model this way does not allow to further define it by important assumptions, for example. This, in turn, is because this definition introduces very different models as part of the canonical tax competition model. Although the definition of the canonical tax competition model is somewhat abstract and hard to reach it is important to emphasize role of the benchmark model. Many of the later studies use this model as their starting point.

4 Further perspectives to theories of tax competition

The previous chapter focused on presenting the benchmark model, other workhorse models and discussing how does relaxing the key assumptions of the benchmark model affect the implications of tax competition. Although the canonical tax competition model is very useful and able to present important implications of tax competition it cannot include some important aspects of tax competition. This chapter provides further perspectives to theories of tax competition.

This chapter broadens the analysis of theories of tax competition in two ways. Firstly, issues that are not a part of the canonical tax competition model are included to tax competition framework. This chapter discusses, for example, the effects of labor markets and foreign direct investments on tax competition. Secondly, this chapter further broadens the methodological views on theories of tax competition. Some models present new modelling methodologies such as overlapping generations models. Some models further develop the methodologies mentioned earlier.

The underprovision of public goods is a strong result of the benchmark model. This result is also a part of many of the models that use the benchmark model as a starting point. However, many of the models presented in this chapter do not study the possibility of underprovision of public goods. Instead the focus is on other issues. For example, it is interesting to study how countries set their tax rates in tax competition when new institutional layers are added to the model economy.

4.1 Further perspectives on competition, trade and asymmetries

This subchapter broadens the discussion of chapter 3.2 about relaxing the key assumptions of the benchmark model. Assumptions that are related to trade and competition are reviewed. In addition, the analysis of asymmetries is further developed.

4.1.1 International trade

The idea of tax competition literature is to model the effects of a situation in which firms have the possibility to locate in different countries. However, most of the early tax competition models do not model international trade. Wilson (1987) models international trade and tax competition. This model is based on a multi-country framework in which economies produce two private goods one of which is more capital intense than the other. Governments use private good as the only input in public good production.

The important implication of this model is that all countries end up producing only one good. In a situation with two industries the changes in the tax rate of a country end up moving the second industry‘s factor-price frontier toward a higher wage rate. This means that industry is left with zero profits. One of the industries will exit the country. Although countries are identical different tax rates and different produced goods are chosen. The equilibrium is characterized by wasteful diversity since it would be Pareto optimal to choose same consumption bundles when countries are identical.

Tax competition model with commodity trade and trade protection is presented by Janeba and Wilson (1999). In this model countries are characterized by two industries that produce different goods with different factors of production. Whereas the first industry uses labor and land the second industry uses labor and capital. Trade protection is modeled by assuming that governments can choose tariff rates. Governments choose tax rates and tax revenue is returned to citizen as subsidy. Governments maximize representative citizen‘s utility which is derived from the two goods.

Governments with lower capital tax rates set lower tariffs. This means that governments may respond to tax competition by reducing trade protection. Without tariffs tax rates may end up to an inefficiently high level but presenting optimal tariffs drives tax rates to inefficiently low level. Less protectionist policies may mean that tax competition is good from the efficiency perspective in international level. On the other hand, the welfare effects of tax competition are dependent on the state of the international developments in trade protection.

4.1.2 Imperfect competition

In the canonical tax competition model firms operate in perfect competition. This means that markets include many producers such that one firm cannot affect, for example, prices. However, many industries have structure that supports the idea of imperfect competition. Instead of many firms there may be only few firms or in the extreme monopoly case just one firm. Janeba (1998) presents a tax competition model in which output markets are based on imperfect competition.

The model applies a duopoly framework. There are two firms one of which is located in the home country while the other is located in the foreign country. Firms produce a homogeneous good which is sold in a third country. There is no consumption in home and foreign countries. Firms choose their location based on the tax rate differentials. The objective of governments is to maximize the net surplus which means the producer surplus plus the tax revenue.

Governments can attract both firms by slightly undercutting the other country‘s tax rates. Governments, however, benefit from this undercutting only when tax rates

are positive and there are no subsidies. If taxes are negative governments will slitghly overcut other country's subsidy. Therefore, tax rates are set to zero. In international trade literature imperfect competition may lead to subsidy competition. When tax competition is present and capital is mobile there is no possibility of subsidy competition.

4.1.3 Market power

The benchmark model as well as most workhorse models model small open economies. Countries do not have the possibility to affect prices or the dynamics of the markets. This changes if countries are assumed to possess market power. Hoyt (1991) studies market power by presenting a model which is build on the framework of the benchmark model. Market power is introduced to the model by reducing the number of countries which is analogous to increasing the market power of a single country.

The starting point of the analysis is a situation with no market power. Reducing the number of countries and, thus, increasing the market power of countries implies that tax rates increase. This results because reducing the number of countries reduces the tax competition externality presented in the previous chapter by internalizing the externality. In addition to tax rates utility increases as a result of marker power. Thus, increasing market power of a country reduces tax competition and increases tax rates and utility.

The market power of countries may appear if some industry is concentrated in a country. If this is the case taxation of mobile capital captures monopoly rents. Governments may, thus, be able to exploit the market power and this way mitigate the inefficiencies of tax competition. This idea is presented by Noiset (2003). However, it remains unclear whether the equilibrium is characterized with underprovision, overprovision or efficient provision of public goods.

4.1.4 Agglomeration

In the benchmark model all countries have equal oppotunities to attract firms. However, some countries may possess agglomerative forces which allows them to maintain higher tax rates and attract or maintain the firms. Country may, for example, have a high quality education system which attracts firms. Some industries may start to concentrate (agglomerate) in the countries. These countries may become the core areas of economies.

Agglomerative forces and tax competition is studied by Baldwin and Krugman (2004). This model is based on a two-country framework in which one of the countries is rich while the other one is poor. The rich country presents the core of the world economy. The results of the model state that the core area has higher tax

rate than the periphery. This is because the core area can capture agglomeration rents since firms are willing to locate in it for other reasons than taxation.

In addition, it is argued that due to agglomerative forces tax competition is one sided. The tax rate setting of the core is bounded by the tax rate setting of the periphery but the same does not hold other way around. The periphery knows that it cannot attract core and can set the tax rate purely on domestic purposes. The core, on the other hand, cannot higher it's tax rate without a bound. It can capture agglomeration rents only to a certain boundary.

Firms may have different productivities and this may affect both tax competition and agglomeration. Heterogenous firms and agglomeration are studied by Baldwin and Okubo (2014). In this model larger firms are more productive and more sensitive to tax rates. There is a larger and a smaller country first of which sets higher tax rate. Larger and more productive firms are important in tax competition and lowering the corporate tax rate may attract more productive firms to the country and improve the aggregate productivity.

Governments may commit to perform certain policies. Commitment is a way to communicate firms, for example, that certain policy is going to happen. Kato (2015) studies commitment and agglomeration in tax competition context. In this two-country framework commitment implies that there is a core-periphery set-up. In presence of agglomerative behavior governments should subsidy firms in order to prevent concentration on one country. Subsidying is, however, costly. Although both governments wish to be the core it is better to be the periphery than one of the countries in a situation in which firms are divided to two countries. This is because periphery country does not need to subsidize firms.

4.2 Vertical and spatial tax competition

Different governance structures are not taken into consideration in the canonical tax competition model. Some countries may, for example, be centrally governed whereas the others may be decentrally governed. In addition to federal government there may be regional or local governments. Many models of tax competition assume horisontal tax competition in which governments of the same horizontal level compete. In vertical tax competition different levels of governments compete. Spatial tax competition which studies metropoly areas, for example, is another way of add a new layer to institutional to framework to study tax competition.

The interaction between horizontal and vertical tax competition is studied by Keen and Kotsogiannis (2004). They model an economy that consist of one federal and many regional governments. This division changes the externalities of tax competition. The horizontal externality is similar to the one presented before and drives federal taxes to be too low. The vertical externality is regional level externality hav-

ing the opposite effect. The interesting implication of the model is that no matter which one of the externalities dominates intensifying of tax competition reduces welfare. If the horizontal externality dominates intesifying regional tax competition drives tax rates even further inefficiently low. If the vertical externality dominates it drives tax rates even further inefficiently high.

This analysis is supplemented by Wilson and Janeba (2005) who model a world economy consisting of two federal governments that are both divided to many identical regions. Public good provision can happen either by federal or regional governments. The supply is, however, different in federal and regional levels. In this set-up countries choose to decentralize. This means that they provide part of the public good in regional level. Decentralization is welfare improving. International tax competition causes welfare losses but decentralization can partly offset these losses. Decentralization creates vertical externalities such that the tax rates in regional level would rise in order to offset the lowering in the federal level. This result, however, only applies to upward sloping tax reaction curves. With downward sloping tax reaction curves decentralization is welfare worsening. With downward sloping tax reaction curves countries end up reducing their combined tax rates. This increases underprovision of public goods.

Spillovers in vertical tax competition framework are studied by Armbruster and Hintermann (2020). This model consist of federal and regional governments such that the regional governments collect taxes and provide public good. The spillover effect is modeled as in the chapter 3.2.3. In addition, a federal transfer system is added to the model. The inefficiency created by tax competition is limited due to the spillover but, on the other hand, it leads to a free-riding problem. Federal governments may commit to a certain policy but since they care about the welfare of the citizens in different areas they may be unable to live up to this commitment. Thus, regions may anticipate that governments redistribute. This means that some regions may be willing to lower their tax rates because they anticipate redistribution and spillovers.

A spatial tax competition model is presented by Braid (2000). This model considers a world economy which consists of many metropolitan areas. The metropolitan areas consists of two local jurisdictions each. This model incorporates a lump-sum tax, an income tax and a corporate tax. When the lump-sum tax is available the jurisdictions choose to use that and not to use other taxes. In this case public good provision is efficient. On the other hand, only business tax being available results in undersupply of public goods. These are very similar results to the benchmark model. It is interesting that if both income and business tax are available jurisdictions choose only income tax which also results in underprovision of public goods. One of the key drivers of underprovision result in this model is surprisingly commut-

ing for work between jurisdictions. In fact, a decrease in commuting costs included in the model worsens the underprovision result. If it is cheaper to commute for work to other areas the result might be that home areas public service levels begin to decline. On the other hand, low levels of commuting costs imply that local governments have greater incentives not to increase the level of taxation.

4.3 Labor markets and income distribution

Many tax competition models do not explicitly model labor markets. Adding labor markets to tax competition framework provides important insights on tax competition. Ogawa et al. (2006) present an extension of the benchmark model with exogenously fixed wages. Utility is obtained from consumption of private and public goods. Citizens are either full time employed or unemployed. Employed individuals get income from wages denoted by $\overline{w}$, capital income denoted by $p\lambda\overline{k}$ and dividends denoted by π and they have to pay a head tax denoted by h. Unemployed individuals have otherwise similar constraint but they do not get wages. Thus, the budget constraints for employed and unemployed can be written as

$$x^j = \begin{cases} \overline{w} + \pi + p\lambda\overline{k} - h \; if \; i = e = employed, \\ \pi + p\lambda\overline{k} - h \; if \; i = u = unemployed. \end{cases} \tag{31}$$

Public goods are financed through capital taxation and a head tax. Governments maximize the weighted welfare of employed and unemployed.

In this model factors of production are capital and labor. If capital and labor are not related in production such that $f_{lk} = 0$ the capital tax is set on zero rate. However, if capital and labor are complementary such that $f_{lk} > 0$ countries set negative tax rates and thus subsidy firms. This is because attracting firms has a positive effect on employment in the case of complementary factors of production. Positive tax rates are set if $f_{lk} < 0$ in which case attracting capital has negative effect on employment. Underprovision may occur in the first two cases. In the third case tax rates may end up inefficiently high. These results are driven by the fiscal and the unemployment externalities. The first one is similar to the externality of the benchmark model. The unemployment externality states that the choices of tax rates affect the employment status of citizens. This effect is, however, ignored in decision making.[12]

The results of Ogawa et al. (2006) are extended by Eichner and Upmann (2012). They use similar model as Ogawa et al. (2006) but define that citizens obtain utility from leisure time also and include an unemployment benefit. Citizens are either full time employed or unemployed. Since individuals receive either wage denoted by w

[12]The production function is assumed to be strictly concave in the benchmark model. Therefore, it does not include similar discussion about the connections of capital and labor as this model does.

or unemployment benefit denoted by $\overline{u}$, capital income denoted by $r\overline{k}$ and dividends denoted by π and have to pay a head tax utility can be written as

$$u_i = \begin{cases} \pi + w + r\overline{k} - h + V(p) & if\ i = e = employed, \\ \pi + \overline{u} + r\overline{k} - h + V(p) & if\ i = u = unemployed. \end{cases} \tag{32}$$

The last terms of equation (32) describe utility from the leisure time. Governments maximize the weighted welfare of employed and unemployed. Instead of fixed labor markets this model assumes efficient labor markets. The wage rate and the level of unemployment are determined in the labor markets and, thus, there may be distortions in the labor markets. In this set-up capital tax internalizes the possible distortion. Labor market distortions are taken into account in the formula of public good provision. If wages and unemployment are negotiated through an efficient solution concept such as the monopoly union or the right-to-manage model the distortion vanishes. In this case undeprovision result reproduces. It is also argued that in other possible cases the likelihood of overprovision is low.

Static search and matching labor market is included to tax competition framework by Hungerbühler and Van Yperselse (2014). Two countries collect tax revenue through income and capital taxation. In the case of symmetric countries tax competition internalizes the externalities of tax competition and the outcome is efficient. In this set-up there is no social gain from attracting more capital. The social and opportunity costs of a vacancy are equal if the search effort is efficient. Labor market frictions and unemployment do not increase the inefficiencies caused by tax competition. Better labor market conditions present upward pressures on capital taxation. Better conditions attract firms to open vacancies in that country. This implies that countries with better labor market institutions are expected to set higher capital tax rates than the countries with worse labor market institutions.

The effect of imperfect labor markets and trade liberalization on the dynamics of tax competition is studied by Egger and Seidel (2011). The interesting feature of this model is that an increase in the labour market frictions between two otherwise symmetric countries increases tax competition and reduces the Nash equilibrium tax rates no matter what are the trade costs. Increase in the labor market frictions mean that countries must respond through the levels of capital taxation. On the other hand, imperfect labor market has a different effect on tax rates depending on the level of the trade costs. If the trade costs are high the capital tax rates respond to increased labor marker frictions in a stronger way. This is because the effects of trade barriers and labor market frictions are connected.

The effect of unionization is studied by Exbrayat et al. (2012). This model builds on a two-country framework in which governments maximize welfare and collect capital tax revenues. In their benchmark case labor markets are competitive.

In this set-up unionizating both countries lowers the level of capital taxation and welfare. Unions imply that higher wages and lower tax rates are required to maintain economic activity. However, if the unions of the countries have different wage preferences the result is different. The country with less rigid labour market can set higher capital tax rate. This is because capital searches to a country with less rigid labor markets although there would be higher level of capital taxation.

Labor unions are also studied by Ogawa et al. (2016) who present a two-country framework in which one country is unionized and the other country is non-unionized. Governments are either thought being nonactive in attracting capital inside its borders or active. Governments use taxes and subsidies as a tool for attracting capital. If government is inactive then the capital market integration harms the unionized country and benefits the non-unionized country. This is because in the becnhmark case unions raise the wage level. Thus, in the unionized country labor is paid more than the marginal product whereas in the non-unionized country this is not the case. Therefore, with integration capital goes to non-unionized country and there is unemployment in the unionized country. If governments are active the result changes. In this case both countries benefit from tax competition. This is because integration incentives the unionized country to compete over investments. Attracting capital increases labor productivity and labor demand. This is a dynamic that lowers the level of unemployment and improves the situation of the unionized country. The situation of the non-unionized is similar as earlier although it has to compete over investments.

Many tax competition models assume that labor is immobile. This assumption can be questioned. Razin and Sadka (2012) study tax competition in a framework in which there is labor and capital taxation and labor mobility is possible. Taxation and migration are connected with a political process through majority voting. In this model the world economy consists of many countries. Part of the countries act as host countries for migrants. Migrants are divided to skilled and unskilled migrants. They serve as labor force in the host countries. Introducing migration with this spesification leads to a situation in which the total population of host countries as well as the skill distribution is endogeneously determined through the migration process. The interesting feature of this model is that tax competition may lead to higher level of taxation in presence of migration. It is assumed that the migrants have no capital. This means that the native-born population of the host countries have to share the capital tax revenue with the migrants. Their labor taxation does not fully fund the public goods they consume. Migration causes a leakage effect in which capital tax revenues leak to the migrants. Countries end up setting too high taxes and offer migrant too high level of public services because of the leakage effect.

A relatively new strand of literature focuses on the effects of tax competition on income distribution. Traub and Yang (2020) present a model that builds on a two-country framework. Citizens are divided to rich and poor and the latter is the median voter and the one who decides the capital tax rate. Between-country inequality is shown to increase because of tax competition while the development of within-country inequality is not clear. Poor people in a small country may accept less within-country redistribution if they are able to benefit from the between-country movement of capital. They provide three distributive effects that affect the changes in income distribution. The fiscal effect means that tax competition reduces capital taxation and lowers redistribution. The tax base effect means that tax competition causes between-country income redistribution since capital moves between countries and tax bases change. The wage effect means that between-country income is redistributed because capital movement affects the wage income. The total effect of tax competition on income distribution is a mixture of these effects.

Tax competition model in presence of income redistribution is provided by Yang (2018). In this model governments are benevolent and tax both labor and capital income. Public goods are divided to two categories. One of the categories benefits high-income persons more while the other benefits low income persons more. The choice of providing one of the categories has distributional consequences. As usual capital mobility reduces the level of income redistribution. This negative effect can be counteracted through two mechanisms. Public good provision that benefits low-income persons could be increased or public good provision that benefits high-income persons could be decreased. Since capital taxation is lower due to tax competition labor taxation could be used to finance the possible expansion of public goods. This, however, requires labor and capital income to be positively correlated since in that case labor taxation has a positive distributional effect. If the effect is negative labor taxation should be reduced.[13]

4.4 Sequential tax competition

In the canonical tax competition model all countries set their taxes at the same time. It is possible that instead of simultaneous tax setting countries set taxes sequentally. There may be a leader in tax competition. This leader makes the first move. After that other countries make their moves based on the leader‘s decision and the responses of other followers. Altshuler and Goodspeed (2015) apply this idea in their three-country model in which one of the countries is a Stackelberg leader. This tax competition game consists of two games. There is a dynamic game

[13]Part of this analysis is based on Yang (2015) who shows that if the correlation between labor and capital income is positive a shift from labor taxation to capital taxation is required when capital markets integrate if redistribution is wanted.

between the leader and the two followers. In addition, followers play a Nash game against each other. Altshuler and Goodspeed (2015) empirically test their model and find evidence on sequential tax competition in which United States serves as the Stackelberg leader.

The theoretical model by Altshuler and Goodspeed (2015) is presented especially for deriving estimable functions and being able to empirically assess tax competition. Theoretical sequential tax competition model is provided by Kempf and Rota-Graziosi (2010) who also endogenize the leadership of tax competition. This model builds on a two-country framework. Production function denoted by $f_i(k_i)$ is allowed to differ across countries. Thus, it introduces asymmetries. Instead of focusing on the underprovision result this model focuses on the leadership in tax competition. This is done by presenting an nondistorting income tax denoted by τ_i. Capital tax denoted by t_i is also included. Including nondistorting income tax ensures the optimal provision of public goods. The representative citizen's utility function can be written with usual notation as $U_i(x_i, p_i) = x_i + p_i$. The budget constraints are given as $x_i = w_i - \tau_i$ where w_i denotes wage and $p_i = \tau_i + t_i k_i$, where k_i denotes capital.

The leadership in the tax competition game is modeled by assuming that countries play a Stackelberg game. The welfare function of a country is defined as profits plus the capital income and can be written as

$$W_i(t_i, t_j) = f_i(k_i) - k_i f_i'(k_i) + t_i k_i. \tag{33}$$

In addition, it is defined that

$$\Phi_i(t_i, t_j) = t_i + k_i f_j''(k_j) \;\; i \neq j.$$

If it is assumed that country j acts as the follower the maximization problem it faces can be written as

$$t_j^F(t_i) \equiv \arg \max_{t_j \in [0,1]} W_j(t_j, t_i),$$

which results in the first-order condition as

$$\Phi_j\left(t_j^F(t_i), t_i\right) = 0.$$

In this set-up country i acts as the leader and the maximization problem it faces can be written as

$$t_i^L \equiv \arg \max_{t_i \in [0,1]} W_i\left(t_i, t_j^F(t_i)\right),$$

which result in the first-order condition as

$$\Phi_i\left(t_i^L, t_j^F(t_i^L)\right) + \left(K_i F_i''(K_i) - t_i^L\right)\frac{dt_j^F}{dt_i} = 0.$$

Compared to the simultaneous move game Stackelberg game always leads to higher equilibrium tax rates when countries are symmetric. The dynamic behind this result is that when the Stackelberg leader increases it's tax rate relative to the Nash equilibrium level it incentives the follower to also increase tax rate. This is because capital tax rates are strategic complements. By an increase of the tax rate country reduces the competitive pressure the other country faces. This is because this decision reduces the capital flight probabilities by lowering the incentives for firms to relocate. Sequential movement allows countries to avoid Nash tax rates by accepting that one of them is the leader. With asymmetric countries the results are not as clear as with symmetric countries.

The leadership of tax competition is endogenized by a timing game[14]. In the timing game countries first decide whether they would like to be leaders or followers. Both countries commit to their choices. In this set-up the subgame perfect equilibria are the Stackelberg equilibria. Sequential movement is Pareto-improving for both countries compared to moving simultaneously. At least one country's equilibrium payoff is higher in the Stackelberg game in which it follows than in which it leads. Thus, this country has the second mover advantage in tax competition. The opposite effect is called the first mover advantage. Because there are multiple possible equilibria there is a coordination issues in choosing the leader. The coordination issues can be solved by Pareto-dominance and risk-dominance criteria. At the risk-dominance subgame perfect equilibria the already well endowed country follows. Basically, this model implies that the small region is the leader of tax competition. This is because the smaller region benefits more from the sequential game. However, this is not a general result. Hindriks and Nishimura (2015) alter the assumptions of the model and find that large countries are leaders in sequential tax competition.

Later research has extended the analysis of Kempf and Rota-Graziosi (2010). Ogawa (2013) considers the capital ownership structure and the implications of it. In a two-country framework the total amount of capital is denoted by $2k$. In country i the initial capital is denoted with $\theta\overline{k}$ such that $0 \leq \theta \leq 1$. Parameter θ denotes the structure of capital ownership. If it is zero capital is fully owned by foreign owners and if it is one capital is fully owned by local owners. Two results with different capital ownership structures are obtained in the timing game. For foreign ownership there are two sequential move equilibria in which one country chooses

[14]In sequential tax competition tradition timing games are applied from the work of Slutsky and Hamilton (1990).

its tax rate early while the other chooses late. For the local ownership there is one equilibrium in which both countries choose their tax rates in the same period. The main result of this model is that if capital is mostly owned by domestic residents the equilibrium tax rates are defined by a simultaneous choice. This is because countries are assumed to be asymmetric and countries with local owners want to manipulate the price of capital. This is because manipulating the price of capital would benefit these countries.

Eichner (2014) extends the work by Kempf and Rota-Graziosi (2010) and Ogawa (2013). The result that there is two sequential equilibria, is obtained if jurisdictions differ in size or with respect to preferences for public goods. The result that equilibria is such that both regions simultaneously move early, holds if jurisdictions differ in productivity. In addition, Eichner (2014) finds an equilibrium in which countries differ in productivity and the more productive country leads the Stackelberg game. The last result is new relative to the earlier contributions. It is also in contrast to that of Kempf and Rota-Graziosi (2010) who found that the less productivity country (the smaller country) acts as the leader.

Hindriks and Nishimura (2017) study capital ownership in the spirit of Kempf and Rota-Graziosi (2010), Hindriks and Nishimura (2015) and Ogawa (2013). They build a model in which capital is partially owned by local citizens and partially by foreign citizens. Their results imply that with low level local ownership the country with higher productivity is the leader. With mid level local ownership only the higher productivity country leadership will be the unique subgame perfect equilibria. With high level regional ownership simultaneous move outcome is like in Ogawa (2013). The new contribution is that they present preference reversion effect of tax leadership. This mean that if capital is partially owned by local citizens tax competition leadership may reverse the preference for taxation of other regions. This is because preferences are endogenous to the distribution of capital.

Sequential tax competition has interesting dynamics in regional level too. Janeba and Osterloh (2013) present a model with metropolitan area and cities. Each city has many associated areas called hinderlands. In the first stage all cities simultaneously determine their tax rates. Then the fully mobile capital moves between cities and all hinderlands choose their tax rates simultaneously. Finally, capital is allocated between the city and the hinderland associated with it. When tax competition is sequential the tax rate of the city converges to zero when the number of cities becomes great. The tax rate of hinderland, in turn, is bounded above zero. These results are in contrast to the simultaneous move situation in which all the tax rates converge to zero when the number of metropolitan areas becoming great. Cities react by shifting taxation to immobile factors (labor) harder than the hinderlands. This is because cities face stronger competitive pressures than the hinderlands.

4.5 Investments and profit shifting

One of the important phenomena in modern business environment is foreign direct investment. Multinational corporations can operate in many countries and the location of investments is important. On the other hand, multinational corporations may shift paper profits instead of investing to foreign country. In addition, bidding literature is briefly reviewed. This literature is based on the fact that governments may want to bid for firms and investments by issuing different subsidy programs.

Profit shifting literature includes general profit shifting models and models that focus on tax havens. As presented earlier tax havens are small countries that offer zero or near to zero capital tax rates and sometimes other special treatment to foreign investments. The impact of tax havens in world economy may be great. For example, according to Tørsløv et al. (2018) multinational corporation shift 40 percent of their worldwide profits to tax haven.

4.5.1 Foreign direct invesment

Multinatinational corporations may be willing to invest in many countries. Haufler and Wooton (1999) model foreign direct investment in a two-country model in which one country has greater population than the other. Both countries have competitive production sector which produces a numeraire good. In addition, countries have another sector in which the production happens under imperfect competition. This model includes international trade and trade costs are modelled. Instead of modelling the possible underprovision of public goods this model studies which one of the countries attracts the investment. It is argued that the bigger country attracts the firm and wins the tax competition. Trade costs are assumed symmetric in which case both countries end up to set negative tax rates. They are willing to subsidy the firm in order to attract it and save the trade costs. The bigger country sets lower tax rate or bigger subsidy since in per capita terms the subsidy is, in fact, smaller.

Often in tax competition literature firms make decisions based on the capital tax rates of countries. Business environment is often more complicated. Different countries may have different depreciation allowances and different regulations. Firms willing to enter the market need to place extra resources in search costs in figuring how the tax systems works. Konrad (2011) studies search costs and concludes that if search costs are high tax competition pressure may be lower and that countries may choose effective tax rates that maximize the tax revenue. If search costs are high only part of firms are willing to place resources in figuring the effective tax rates of countries and tax competition pressures are, therefore, lower.

Investors may have an attachment to a country.This changes the idea that investment locations are purely chosen by tax rate differentials. Home bias in which investor is more willing to invest in the home country is an example of this kind

of behavior. Ogura (2006) studies effects of home bias in tax competition. This model is otherwise very similar to the benchmark model but individuals in country i are indexed by n_i which is uniformly distributed over $[0, 1]$ and allows to write the budget constraint of the type n_i individual as

$$c_{n_i} = \begin{cases} w_i + p_i \\ w_i + p_i - ya\left(n_i\right), \end{cases} \tag{34}$$

where the first equation describes the budget constraint when capital is invested in country i and the second equation describes the budget constraint when capital is invested in the other country. In the second equation of equation (34) the term $ya\left(n_i\right)$ describes the cost of investing to other regions. This cost is related to the attachment to home. Performing similar calculations as for the benchmark model shows that public goods are underprovided. The interesting issue, however, is that underprovision is smaller than underprovision in the case with no attachment. This results seems intuitive. With attachment to home investors are more willing to invest to home country even with higher capital tax rates. This reduces the underprovision of public goods compared to the case with no attachment.

4.5.2 Bidding

In present business environment countries aim to attract industries and firms. Countries may, for example, subsidy firms or certain industries in order to attract them. Subsidies are part of the analysis above but there is an own literature strand focusing on this behavior called bidding over firms.[15]

The first formal bidding model is presented by Black and Hoyt (1989). In this model two countries compete over two industries. Both industries consists of one large and many small companies. Countries provide investment incentive programs for the firms in order to attract them. In this model bidding is welfare improving. Bidding ensures the efficient location of the firm and can only increase social efficiency. The location of the firms creates positive spillover effects since small firms may also want to locate to the country after the large firm has.

Bidding may take place in different forms. Furusawa et al. (2015) present a bidding model that operates based on an English auction[16]. Countries may induce each other bidding further. The equilibrium winning bid is greater in English auction. This may result as an inefficient location of the foreign direct investment. In

[15]Descriptive evidence on bidding behavior is reviewed by Greenstone and Moretti (2003).

[16]English auction means an auction mechanism in which the auctioneer opens an auction and allows participants to raise their bids openly. Eventually only one bidder is left and she gets the item. English auction is one auction mechanism. The others are the Dutch auction, the first-price sealed-bid auction and the second-price sealed-bid auction. McAfee and McMillan (1987) review auction mechanisms and their properties.

an English auction there are incentives for firms to encourage countries to respond to bids. This generates uncertainty about the winner‘s identity and the winning bid. In this case bidding may not be welfare improving. The investment incentives may be too large and the societal benefits may be transferred to the firm. This phenomenon is in the literature known as the race beyond the bottom. It deepens the race to the bottom hypothesis of the benchmark model.

If markets are operating in an imperfect manner and international trade is possible governments may not need to bid. This argument is presented by Ferrett and Wooton (2010) who model competition over foreign direct investment in a duopoly with two countries and two firms. In this scenario because of the trade costs firms need to spatially separate themselves in order to enjoy higher profits and thus locate one in each country. Ferrett and Wooton (2020) further develop the framework by considering a scenario in which countries can bid only over one firm. In this game countries anticipate the results of the bidding and the losing government is better not to participate. Instead it can try to attract the other firm.

Political economy of bidding is considered by Hopp and Kriebel (2019). In their model median voter offers the bid and countries may have low-skilled or high-skilled majority. It is welfare enhancing to regulate granting of subsidies because it prevents minority to exploit majority. In addition, it is argued that regions with low-skilled majority may not have the political support for higher bids. This is because they may have lower incentives to pay for the location of the firm. As a result of the location decision high-skilled individuals end up with higher wages but the low-skilled individuals may end up with higher rents or benefit less relative to the high-skilled individuals.

4.5.3 Profit shifting

Multinational corporations may engage in profit shifting in order to reduce their tax burden as decribed in chapter two. Keen and Konrad (2013) reverse the commodity tax competition model of Kanbur and Keen (1993) to a corporate tax competition model focusing on profit shifting. The original model assumes a borderline region between two countries such that inhabitants of the countries can shop in either side of the border. Commodity tax rate differs between countries and consumers may want to shop in the country in which it is cheaper.

Underprovision of public goods is not modeled but it is shown that smaller countries set lower tax rates. It is assumed that two countries ($i = 1, 2$) lenght of unity are located in a line where there is a border in the middle. Population size given by h_i differs between the countries. Citizens buy one unit of good. If good is bought from the home country denoted by $i = 1$ citizens pays the home country tax denoted by t_1. If good is bought from the foreign country citizens pays the foreign

country tax denoted by t_2 and a transportation cost denoted by δ. It is assumed that home country has lower tax rate. In this case all home country inhabitants buy the domestic good. Inhabitants of the foreign country also buy from the home country if $t_1 + \delta < t_2$. This means that a proportion denoted as

$$s = \frac{t_2 - t_1}{\delta}$$

buy from the home country. Thus, the tax revenues of the countries can be calculated by summing the tax revenue from domestic shoppers and from foreign shoppers for the country number one and by substracting the tax revenue going abroad to the total revenue for the country number two. Maximizing revenues yields the Nash equilibrium tax rates denoted by $\tilde{t}_i$

$$\tilde{t_1} = \delta\left(\left(\frac{2}{3}\right)\frac{h_1}{h_2} + \frac{1}{3}\right) \; and$$

$$\tilde{t_2} = \delta\left(\left(\frac{1}{3}\right)\frac{h_1}{h_2} + \frac{2}{3}\right). \tag{35}$$

If the tax rate in the smaller country is lower there exist a Nash equilibrium given in equations (35). This implies that smaller countries set lower tax rate. However, it is useful to note that the reasoning is opposite to that of the benchmark model. Instead of deriving tax rate as in the benchmark model this model assumes tax rates and shows that a Nash equilibrium exists. This is important since Nash equilibrium does not always exist.

Idea of this model is reversed to study tax competition in presence of profit shifting. Instead of assuming cross border shopping it is assumed that a multinational corporation operates in both countries. It is also assumed that country number one has lower tax rate such that multinational has an incentive to shift profits to this country. The fraction of profit shifted from country two to country one is denoted with s. Shifting operations are costly since there are costs to design shifting and a risk of penalty. Therefore, the cost is assumed to take a form given by $\frac{1}{2}\delta s^2 \Pi_i$ where the last term denotes the profits of the multinational firm in country i. Profit of the firm can be written as

$$\Pi = \Pi_1 + \Pi_2 - t_1\left(\Pi_1 + s\Pi_2\right) - t_2\left(\Pi_2 - s\Pi_2\right) - \frac{1}{2}\delta s^2 \Pi_2. \tag{36}$$

Maximizing equation (36) with respect to s_i shows that the result given by equations (35) holds in profit shifting framework such that Π_i replaces population shares. This means that the model by Kanbur and Keen (1993) can be translated to become a profit shifting model. On the other hand, Keen and Konrad (2013) note that this result also means that instead of country being smaller in the population sense it

may have lower aggregate productivity and, thus, set lower tax rate. If country has low aggregate productivity it loses little revenue by lowering it's tax rate but can attract profits from other countries and, thus, gain revenue. This intuition makes it sensible that countries with lower aggregate productivity set lower tax rate.

Implications of profits shifting are studied by Eichner and Runkel (2011). In this multi-country model one representative multinational corporation has a plant in each country. The multinational corporation may shift profits and shifting is denoted by s_i. If term s_i is greater than zero multinational corporation shifts profits to this country and if it is smaller than zero it shifts profits from this country. If the multinational engages in profit shifting it must pay concealment costs to make profit shifting possible. These costs are presented in the model as concealment costs by a U-shaped function $C(s_i)$.

Production technology is decribed by a production function $f(k_i, l_i)$ such that capital and labor are the factors of production. It is assumed that capital pays interest denoted by r. Part of the capital cost is deductible. The fraction of deductible cost is denoted by $p \in [0, 1[$. Labor is paid with wage rate denoted by w_i. With these definitions the tax base of multinational in a country i can be written as

$$\phi_i = f(k_i, l_i) - prk_i - w_i l_i + s_i. \tag{37}$$

Each country has a profit tax denoted by t_i. The total profits of the multinational corporation can be written as a function of the tax base given in equation (37), the capital costs and the concealment costs as

$$\pi = \sum_{j=1}^{n} (1 - t_j)\phi_j - r \sum_{j=1}^{n} k_j - \sum_{j=1}^{n} C(s_j). \tag{38}$$

The multinational corporation maximizes profits. As usual an unilateral increase in the profit tax rate reduces capital in the country. On the other hand, capital and labor are complementaries. This implies that a decrease in capital reduces labor demand. This, in turn, implies that the wage rate decreases as a result of an unilateral increase of the tax rate. In addition, if a country unilaterally raises it's tax rate the multinational lowers the level of profit shifting to this country and increases it to other countries.

Governments maximize tax revenue[17]. Profit shifting and tax competition cause two externalities. Profit shifting externality presents the dynamics in which an increase in tax rate of a country incentives the multinational corporation to shift profits to the other countries. This externality drives tax rates to inefficiently low levels. Tax base externality presents the effect of one country's tax rate to the true

[17]Leviathan behavior is discussed in chapter 4.6.

tax base of other countries. The true tax base is profits less profit shifting.

The sign of this effect is ambiguous because it is derived from several subeffects. Increases in one country‘s tax rate cause a decrease in capital demand and world interest rate. This positively affects the tax base of other countries because capital costs are lower. In addition, reduction in interest rate increases investments to this country. Capital and labor are assumed to be complementary. This means that labor demand increases in the other country and causes wage rate to increase. This has a negative effect on the tax base. Together profit shifting externality and the tax base externality imply a situation in which the Nash equilibrium tax rates are inefficiently low. The effect of profit shifting externality is clear. Tax base externality can partly but not fully offset this effect. This result is similar to earlier models. However, the endogenously given interest rate makes the inefficiency of tax rates less visible because of the possible offsetting of the tax base externality.

Multinational corporations can shift profits via several channels. Choi et al. (forthcoming) study the incentives to shift profits via transfers mispricing[18]. Their model builds on a two-country framework in which one country is a low-tax country while the other is a high tax country. Multinational corporation behaves monopolistically and chooses monopoly price as the transfer price. Because multinational corporation uses monopoly price as the transfer price the home government may want to limit transfer mispricing and responds with more stringent transfer pricing regulation. The interesting feature of the model is that it is shown that both the high tax and the low-tax countries want the high tax country to legislate stringent enough transfer price regulation. This is because with stringent enough transfer pricing regulation the high tax country adjusts to some level of profit shifting since it allows to maintain higher tax rate. The low-tax country also wants the high tax country to set stringent enough transfer price regulation. This is because with too light transfer pricing regulation race to the bottom occurs and eliminates the incentives for profit shifting. Thus, race to the bottom would harm the low-tax country too.

Labor markets are added to profit shifting framework by Krautheim and Schmidt-Eisenlohr (2016) who study tax competition with profit shifting and wage bargaining in a two-country framework. The model consists of a large high tax country with monopolistically competitive sector and a small low-tax country that has an affiliate of the multinational firm in it. Governments of both the low-tax and the high tax countries are assumed to maximize the welfare of their citizen‘s. The interesting feature of this model is that it shows that profit shifting reduces the wages of the employees in addition to reducing the tax revenue. Multinational corporation has operations in both countries. The employees only know the productivity of their

[18]See chapter 2.2 for arm‘s lenght pricing and other principles of international taxation.

own plant but not the productivity of other plants of the multinational corporation. Thus, the employer has an informational advantage. When wages are bargained firms are able to get rent in the form of lower wages because they can shift profits to the low-tax country.

Foreign direct investment and profit shifting is united with a discussion about the institutional quality of the tax administration of a country by Gresik et al. (2020). In this model there is a single national welfare maximizing host country for foreign direct investment and a continuum of multinational corporations able to shift profits via transfer prices and internal debt. They argue that foreign direct investment improves every country‘s welfare because production increases as a result of it. However, the increase may be outweighted if quality of tax revenue administration is weak. The quality of administration means the ability to audit and correct transfer mispricing behavior. This is because with weak institutional quality multinational can shift more profits. This, in turn, increases corporate tax revenue losses. In addition, if the quality of the tax revenue administration is weak countries may put such policies in place that are bad for investment.

4.5.4 Tax havens

Profit shifting can occur in two ways. Profits can be either shift to other high tax country with a lower corporate tax rate or to tax haven. Tax haven are often small nations which offer near zero taxation and possibly other investment incentives[19]. Dharmapala (2008) reviews the literature on the consequences of tax havens to the high tax countries. The existence of tax havens increases tax competition. The high tax countries may choose lower tax rates than they would when competing only with other high tax countries. On the other hand, tax havens may be good for the welfare of the high tax countries too. This is idea supported by the fact that at least part of tax haven operations could be forbidden by simple legislation but countries have not done that. Therefore, the effects of tax havens seem not clear at all.

Tax havens are included to tax competition framework by Slemrod and Wilson (2009) who model tax havens as parasites that take tax revenue from other countries. This model is an extension of the benchmark model. Firms are assumed to be making a choice whether to participate to profit shifting or not. If firm chooses to participate it has to pay set-up and concealment costs. Governments try to restrict profit shifting to tax havens and, thus, have enforcement expenditure. The objective of the government is to maximize utility of the representative citizen. It is shown that the existence of tax havens is welfare worsening. Without tax havens all countries could increase public good provision by increasing taxation in such that

[19]Broader discussion on development of tax havens and their operating is provided by Garcia Pires (2013).

the wage rate remains fixed since capital stock does not change. Eliminating tax havens does not change the factor prices but increases private consumption. This is because there are efficiency gains. A rise in private consumption increases the marginal benefit from public good consumption since public good is a normal good. Thus, eliminating tax havens raises the equilibrium level of public good provision and increases the welfare in the high tax countries.

Another approach to modelling tax competition and tax havens is provided by Hong and Smart (2010). This model is based on a two-sector framework with workers and entrepreuners. One of the sectors uses imported capital and domestic labor and is called the multinational sector. The other sector uses domestic capital from entrepreuner class and labor. Both production technologies can be used to produce single homogeneous consumption good. This set-up implies very different results than that of Slemrod and Wilson (2009). An increase in international tax planning causes an increase in the tax rate and welfare. The key driver of this result is a mechanism which shows that tax planning reduces the tax revenue but it also makes the location decisions of a multinational less responsive to the tax rate differentials. The second effect which is called the investment-enhancing effect dominates the first effect called the revenue-erosion effect. This model, thus, presents a contrary view to that of Wilson and Slemrod (2009).

Another more positive view on tax havens is provided by Johannesen (2010) who argues that tax havens may have a positive total effect on the tax revenue of the high tax countries. According to this view tax revenues of the high tax countries are affected by tax havens through leakage effect, competition effect and crowding effect. Leakege effect works by reducing the tax base of the high tax countries. Competition effect presents downward competitive pressures on tax rates posed by the presence of tax havens. Both of these effects have negative implications for tax revenue of the high tax countries. However, the total effect of tax havens on tax revenue of the high tax countries may be positive. This is because the crowding effect may outweight the two other effects. The crowding effect is defined as an effect in which the low-tax countries increase their tax rates since does not seem good to compete with tax rates in presence of tax havens. Since the crowding effect means an increase in tax revenue the total effect on tax revenue depends on the volume of leakage, competition and crowding effects respectively.

Heterogeneous profits are added to tax haven framework by Krautheim and Schmidt-Eisenlohr (2011). In their model there is a high tax country in which firms operate monopolistically. Firms face taxation which they may want to avoid by opening an affiliate in the tax haven. The high tax country and the tax haven play a simultaneous move Nash game and decide their tax rates noncooperatively. The gains from profit shifting depend on the level of profits a firm has. In the equilibrium

the most productive firms shift profits. Usually larger firms are more productive and they have better possibilities to shift profits. This implies that tax competition is strongest when the distribution of firm profits is such that productive firms account for a large share of the total profits. Thus, the distribution and changes of firm profits affects whether tax competition increases or decreases.

It may be that the tax policies of countries are affected by interest groups. Chu et al. (2015) present a tax competition model in which many high tax countries compete for mobile capital and tax havens exists. Capital owners in the high tax countries create a lobbying organizations which put pressures on the politicians to lower the level of capital taxation. Profit shifting to tax havens drives capital out and makes the immobile tax bases to carry the tax burden. Owners of capital want to avoid this by lobbying. It is argued that in the equilibrium tax rates are inefficiently low. An increase in profit shifting reduces welfare of the high tax countries if the political effect of lobbying drives tax rates further down under the efficient level. However, there is also a welfare improving effect of profit shifting which. Allowing differential tax treatment for mobile and immobile capital is welfare improving. If this effect outweights the political effect an increase in profit shifting is welfare improving for the high tax countries.

4.6 Political economy and tax competition

Political economy of tax competition is not part of many of the early models of tax competition. However, political economy of tax competition is a fruithul theme of research. One important political economy question concerns the objectives of government. In the benchmark model governments are benevolent. This means that governments maximize utility of the representative citizens. The assumption of benevolent governments has been questioned and there is a wide discussion about other possible objectives of governments[20]. Instead of benevolent behavior it is proposed that governments maximize tax revenue or in some cases their own utility. This kind of government is called Leviathan.

Leviathan behavior and tax competition is by studied Edwards and Keen (1996). The government‘s objective connect benevolent government and Leviathan behavior. The model builds on the benchmark model but politicians maximize utility that is derived from utility of the representative citizen and from an item in that benefits only the politicians. Collected tax revenue must finance both public goods and the item that benefits only the politician. Following the steps of chapter 3.1.1 yields that public goods are underprovided. The result is intuitive since governments use tax revenue not only to public goods but also in their own interest.

[20]See, for example, Oates (1985), Forbes and Zampelli (1989), Oates (1989), Zax (1989) and Brulhart and Jametti (2019) for a discussion.

Usually the objectives of government are exogenously given. Pal and Sharma (2013) endogenize the objectives of governments. It is shown that it is optimal for countries to choose tax revenue maximization behavior (Leviathan) instead of welfare maximization (benevolent). This is because welfare maximization increases tax competition. Countries are more aggressive relative to tax revenue maximization if welfare maximization is the objective. They want to decrease tax rate more than other countries have decreased. This result shows that race to the bottom can be restricted when countries move from welfare maximization to revenue maximization.

Wang and Ogawa (2018) further develop this framework by assuming that capital is owned by foreigners owned and capital supply elasticity with respect to interest rate is positive. If capital supply elasticity with respect to interest rate is low welfare maximizing governments choose Leviathan behavior. With low capital supply elacticity with respect to interest rate governments maximize the welfare of the citizens better by acting as Leviathans. In Kawachi‘s et al. (2018) model capital can be domestic or foreign owned. The structure of the ownership affects the incentives of governments. Foreign owners prefer small tax rates since return goes abroad. In this case governments choose Leviathan behavior. If capital is domestic owned governments choose a mix of Leviathan and benevolent behavior. These results reflect the fact that with foreign owned capital Leviathan behavior (revenue maximization in this case) is the best way for governments to act.

The benchmark model and almost all later literature assumes that governments behave in a Nash manner. This means that the optimal response is the one that provides the maximum welfare. Eichner and Pethig (2020) reconsider this assumption and propose that governments may act in a Kantian manner. This means that countries are guided by the Kant‘s categorical imperative[21]. The analysis is performed in a two-country framework in which one or both countries can be Nashian or Kantian. The model suggest that a Kantian country always chooces a higher tax rate than a Nashian. This is because the Kantian has a steeper best response curve than the Nashian. On the other hand, the results depict the fact utility in the country behaving in Kantian manner is greater which makes it intuitive for choosing Kantian behavior. The key driver of these results is that Kantian behavior decreases the harmful effects of tax competition which are present in Nashian behavior.

In addition to the diversity of government behavior the canonical tax competition model lacks democratic decision making process. Persson and Tabellini (1990) consider a two-country tax competition model with two periods. Countries are assumed to organize elections in which governments are chosen. The chosen govern-

[21]Kantian behavior in economics is based on the analysis by Romer (2010) and it is further developed by Romer (2015). The main difference between Nashian and Kantian behavior is that Kantian behavior results in efficient solution with negative and positive externalities which is not true for Nashian behavior.

ment chooses the policy conducted. The political process depicts the fact that the chosen politicians may have different policy preferences than the median voter. It is shown that policy mechanism offsets some of the negative consequences of tax competition by choosing new politician who is more "left-leaning" than the earlier one. Thus, the tax rate may not lower as much as it would with the old politician. These results reflect that political processes may be a key factor in maintaining positive levels of corporate taxation. In fact, it may be that political process decreases tax competition.

Political decision making process and sequential tax competition are united by Pal and Sharm (2019). The politicians are elected by majority voting and then the politician of the leader country decides it's tax rates. After that the politician in the follower country observes the tax rate of the leader and decides it's own tax rate. Finally, investors with mobile capital choose how to allocate resources between these countries. It is argued that the follower country chooses a government that has higher preference for public good than the median voter. In the leader country the median voter herself becomes the politicians. These results are driven by an anticipation effect. Follower country makes political delegation first by appointing politician with high preferences for public good because it anticipates that as a follower it is incentiviced to set lower tax rate. By making the political delegation first the follower country incentives the leader country to set higher tax rate than it would otherwise had. Sequential choice in political process set-up, thus, restricts the race to the bottom because with this mechanism undercutting race may not occur.

The effects of tax competition under different political systems are studied by Janeba and Schjelderup (2009). The key idea of this model is to compare presidential-congressional and parliamentary regimes. In the first system tax and exdenditure policy are assumed to be legislated by different individuals whereas in the second one same individuals legislate both. Politicians are viewed as rent seekers. However, due to re-election concerns politicians are somewhat interested in public service also. Under the presidential regime tax competition does not affect the public good supply since different persons decide the tax and expenditure policy. Since the tax rate decreases due to tax competition citizens are better off. In the parliamentary regime tax competition increases the underprovision of public goods. If public goods are sufficiently valued tax competition may make citizen worse off. Thus, if same persons decide budget as a whole tax competition may worsen welfare but if different persons decide different parts of budget tax competition may increase welfare.

The preferences of citizens are interesting in tax competition. Tiebout (1956) describes society in which citizens choose their locations based on their preferences. Brueckner (2000) considers tax competition when the preferences of citizens differ. Public goods are provided by a community developer who wants to earn profit from

the provision of public good. In this model countries are formed by community developers and consumers then sort based on their preferences. In equilibrium high-demand communities have high tax rates and small capital stocks. Low-demand communities have low tax rates and large capital stocks. As in the benchmark model the country that sets high tax rate enhances the outflow of capital to other countries.

Aging is a wide phenomenon is western countries in the 2000s. It affects both the supply and the demand side of the economy. In addition, it may affect the politics. Older persons are more likely to vote. This may affect the choice of policy. Tax competition and aging is considered by Morita et al (2020) who present a two-country overlapping generations model in which one country has growing (young) population while the other has declining (aging) population. Politicians commit to a certain corporate tax rate and are elected through majority voting. Corporate tax, thus, reflects the preferences of voters. The results of the election depend on the structure of population. If population is growing young people represent the majority and if it is declining old people represent the majority. This model implies that race to the bottom occurs if individuals prefer public good consumption over private good consumption. If not capital taxation is set inefficiently high which results to a race to the top. Race to the top is more likely to occur in society with declining population. This is because capital taxation has a negative effect on domestic younger people. This effect is not present in society with growing population. In addition, the outflow effect of capital is more damaging in society with aging population.

4.7 Discussion on further perspectives to tax competition theory

This chapter broadens the perspectives on tax competition. Institutional frameworks that are not part of the canonical tax competition model are introduced and their impact on tax competition is studied. On the other hand, methodologies of modelling tax competition are further widened although most of the applied methodologies are presented in the previous chapter. However, in this chapter it is highlighted that different phenomena may demand different methodology. For example, studying the effects of aging on tax competition may demand overlapping generations model.

All issues studied in this chapter are important in order to fully understand the dynamics of tax competition. However, parts of the chapter stand out. Income redistribution and inequality has become an important theme in both economics and public discourse. It seem natural to expect that the importance of tax competition research on these themes increases. These issues are also a part of the tradition

studying labor markets and tax competition. Another possibly rising theme for future research is the effect of tax competition on employment.

In addition, issues relating to investment are important. Tax competition is possible because multinational corporations have possibilities to invest abroad and shift their profits. Thus, it is important to understand the dynamics of these issues. Tax haven literature is young and developing. It is interesting because two views can be separated. The view based on the tradition starting from Slemrod and Wilson (2009) views tax competition as harmful whereas the tradition starting from Hong and Smart (2010) views it as non-harmful. These traditions have opposite understanding on the implications of tax havens. The first traditions views tax havens as parasites. Tax havens erode the tax revenue of the high tax countries. The second tradition views profit shifting to tax havens as an efficiency enhancing issue. Because profit shifting to tax havens is possible location decisions may not be as sensible to the tax rate differentials. It is interesting to see how these traditions develop and if there is convergence between the opposing views.

In decentrally governed countries vertical tax competition may be especially important issue to understand. Tax competition may drive tax rates down in national level due to international pressures. However, the response of regional governments may be to increase their tax rates. Thus, vertical tax competition may offset part of the harmful consequences of tax competition. This view emphasizes the role of national and regional governments. The dynamics of vertical tax competition may have implications to regionalities being providers of public services.

Sequential tax competition is important for fully understanding the dynamics of tax competition. The benchmark model as well as many later models of tax competition view tax competition as a simultaneous move game. However, it seems natural that some countries act first. It may be that tax competition starts with a conscious decision. This may explain why race to the bottom is not observed. Firstly, tax rates are higher in sequential tax competition in simultaneous tax competition.

Secondly, sequential nature of tax competition implies that there could be cycles of tax competition. The leader may decide after one round of lowering tax rates, for example, that there is a break in tax competition. This break may last for a while. However, at some point it may be that the leader decides to start tax competition again. There is evidence that, for example, the tax reform of United States in 1986 served as a watershed moment for tax competition (Altshuler and Goodspeed 2015). These moments can be seen as starting points of new cycles of tax competition.

One interesting issue is to considered is that in which cases tax competition increases and in which cases it decreases. Some models explicitly answer this question while the others do not. In the benchmark model tax competition increases when some country lowers it‘s tax rates. This is because lowering the tax rate incentives

other countries to lower their tax rates. Tax competition may incease also if labor market frictions between symmetric countries increase or if governments change their objectives from revenue maximization to welfare maximization. On the other hand, tax competition decreases if the market power of countries increases or if tax competition is sequential instead of simultaneous.

One of the important questions of theories of tax competition is whether tax competition is harmful or not. It is difficult to address this question comprehensively for multiple reasons. Firstly, there is no joint definition of harmful. Secondly, tax competition is an international phenomenon. Therefore, harmful to some countries may be good for the others. It may be that, for example, as a consequence of tax competition some high tax countries witness decreasing corporate tax revenue whereas the others are able to attract the firms and benefit from their presence.

Something can be said about the possible harmfulness of tax competition based on the research literature. Firstly, in the literature stemming from the benchmark model natural definition of harmfulness is that tax competition is harmful if it causes underprovision of public goods. This definition implies that tax competition is harmful according to many model of this tradition. Since tax rates are driven too low to provide an efficient level of public goods tax competition is an unwanted phenomenon.

On the other hand, tax competition can be seen as non-harmful. As described above part of tax haven literature views tax havens and tax competition as non-harmful. Since tax havens may make the location choices less respondent to the tax rate differential tax havens improve the positions of the high tax countries. In addition, part of political economy tradition views governments as Leviathans. Tax competition restricts the power of single governments. Therefore, governments cannot expand themselves as much. Thus, tax competition enhances efficiency and is non-harmful.

Theoretical aspects of harmfulness described above are important in providing insights to the question. A complete answer requires asnwers to spesific subquestions. For example, it would be important to understand the effect of tax competition on economic growth. Many of the welfare institutions of westerns countries are financed through increased tax revenue. This, in turn, is a consequence of economic growth and improved collection of taxes. For the future of public finances it would be essential to understand the connection between tax competition and economic growth.

On the other hand, tax competition may have effects on inequality, employment, tax revenue and the composition of public goods. All these issues affect the welfare of citizens. There is already some research on these themes but more is demanded. Before proceeding to answer the question one should answer all the subquestions

above. These subquestions are, however, out of the scope of this thesis. They are introduced as an agenda for future research in order to be able to address the harmfulness of tax competition.

If tax competition is hamrful it favors to limit it. Part of the dimensions of hamrfulness of tax competition are policy-oriented such as the initiatives of OECD to prevent hamrful tax competition. In fact, the OECD efforts imply that tax competition is hamrful. Governments are willing to coordinate in order to limit tax competition. This suggests that governments view tax competition as harmful. If it would not be harmful governments would not put resources in efforts to limit tax competition.

On the other hand, it does not seem clear how severe are the consequences of tax competition. Corporate income tax rates have fallen but are yet far from zero and corporate tax revenues have to some extend remained stable. However, it can be that the decline of corporate income tax rates continues. Lower levels of taxation transmit to economy and social policy as less capability to maintain public service and transfer levels. This may be a challenge for modern welfare states. Harmonization of taxation is politically hard in international level but the initiatives of OECD aiming to a minimum tax rate and division of taxing rights are a useful start.

5 Conclusions

This thesis reviews theories of tax competition. The focus is on surveying theoretical modelling tax competition. In addition, studying the effects of different institutional frameworks on the dynamics of tax competition is important. The choice to highlight the institutional complexity of tax competition broadens recent review literature which focuses on policy issues such as limiting tax competition and profit shifting (Keen and Konrad 2013; Baskaran and Lopes da Fonseca 2014).

Chapter two focuses on the institutional backround of tax competition. It is shown that the principles of international corporate taxation created at the 1920s have an impact on tax competition. These principles are created for a different business environment. The rise of new business models shows that there are problems in applying these principles in modern business environment. The contradiction between the principles of international corporate taxation and modern business models sets part of the institutional foundations of tax competition.

Chapters three and four discuss theories of tax competition. Chapter three presents the canonical tax competition model and discusses the effects of changing the key assumptions of the benchmark model. The famous underprovision result is discussed. Chapter four reviews further developments of theories of tax competition. It is shown that tax competition is modeled applying different institutional frameworks. Modern phenomena like tax havens have become an important part of theories of tax competition.

The first research question this thesis aims to answer is how should the canonical tax competition model be defined. Canonicality is used in earlier literature but defining it has been problematic. This thesis proposes that in the context of theories of tax competition canonicality should be seen through the history of economic thought of tax competition. Instead of viewing the canonical tax competition model as a single model it is an abstraction in which the most important ideas of different modelling traditions unite.

The second theme of research questions concerns the implications of tax competition. It was argued that this thesis should answer whether the underprovision result of the benchmark model holds with more general assumptions. As shown and discussed earlier the underprovision result is strong and often holds even though the key assumptions are relaxed. The underprovision results is interesting. Based on the spesifications of utility and production functions and other key variables it seems hard to reach conclusion other than underprovision of public goods.

The assumptions about the nature of production function are, for example, strong. These assumptions may be easy to justify. However, if the assumptions of production function are relaxed the underprovision result changes[22]. Although

[22]This issue is briefly discussed at the beginning of chapter 4.3.

the underprovision result is strong it may be that it is a necessary implication of the methology used in the benchmark model. On the other hand, the underprovision result is intuitive and useful which may explain the key role it plays in tax competition literature.

Another research question of this thesis is to describe the key implications of models that do not model underprovision of public goods. One of the key insights provided in the thesis is that different sized countries play different roles in tax competition. There is, for example, both empirical and theoretical evidence that bigger countries act as leaders of tax competition. On the other hand, they may often succeed in attracting investment because it is less costly or because there may be agglomeration forces. A key theme relating to both asymmetries and sequential tax competition is to understand the long term nature of tax competition. Especially interesting issue is whether there are cycles of tax competition. It is possible that tax competition proceeds in different speeds in different decades. On the other hand, the role of larger and smaller countries is essential in understanding the possible cycles of tax competition and the dynamics they have.

In future research the role of international organizations should be highlighted. Issues focusing on limiting tax competition are out of the scope of this thesis but the impact of players like European union or OECD should be highlighted from a new perspective. European union brings together smaller nations that together form a bigger entity. It would be interesting to study the implications of this player in tax competition. On the other hand, literature on foreign direct investment and profit shifting is current. The ongoing work to limit profit shifting and tax competition urges more knowledge about these issues.

Almost all literature presented focuses on theories of tax competition. Another prominent field for future research is the empirics of tax competition. Empirical modelling of tax competition is a growing field but it faces some issues regarding how to measure and estimate tax competition. On the other hand, theoretical models make it possible to derive estimable tax reaction functions such as those of Devereux et al. (2008) or Egger and Raff (2015). Theoretical literature can also give empirically testable hypotheses.

The dynamics of tax competition are very interesting. Eventually, the key issue is whether tax competition is harmful or not. It is not clear whether this can be justified based on earlier research but for policy makers it is of first class importance. If the initiatives aiming to limit tax competition such as the work of OECD want to be successful there should be a joint view on the harmfulness of tax competition. Since work is done to limit tax competition it seems natural to assume that politicians view it as harmful.

However, research can provide insights to this question as argued in the discussion

of chapter four. Tax competition can be seen as harmful when welfare decreases as a result of it. Thus, based on research literature tax competition can be seen as harmful in many cases. In addition, future research could try to figure out the consequences of tax competition on economic growth, inequality, total tax revenue and composition of public goods. Gaining wide enough perspectives on different aspects of harmfulness would enhance the possibilities to answer the question with certainty.

In the end, the suitable level of corporate income taxation is a political decision. However, it is good to keep in mind that taxation has effects described in the second chapter of this thesis. On the other hand, increased international competition may have results described by the underprovision result. Based on this thesis it seems useful to be concerned about tax competition. An important part of the total tax revenue is collected through corporate income taxation in many countries. Too much downward pressure may lead to possibly harmful decisions such as lowering the level of public services or substituting the loss corporate tax revenue by other taxes. This means that the tax burden of others may increase as a result of tax competition.

References

Aalto, Assi, Ahola, Ilari, Hytönen, Jukka, Paavonen, Marja, Palmén, Olli, Pääkkönen, Jenni and Tamminen, Veliarvo (2020): Suomen julkisen talouden kestävyys. Valtiovarainministeriön julkaisuja 2020:59.

Altshuler, Rosanne and Goodspeed, Timothy J. (2015): Follow the Leader? Evidence on European and US Tax Competition. Public Finance Review 2015, 43, 485-504.

Armbruster, Stephanie and Hintermann, Beat (2020): Decentralization with porous borders: public production in a federation with tax competition and spillovers. International Tax and Public Finance, 27, 606-642.

Baldwin, Richard and Krugman, Paul (2004): Agglomeration, integration and tax harmonisation. European Economic Review, 48, 1-23.

Baldwin, Richard E. and Okubo, Toshihiro (2014): Tax Competition with Heterogeneous Firms. Spatial Economic Analysis, 9, 309-326.

Baskaran, Thushyanthan and Lopes da Fonseca, Mariana (2014): The Economics and Empirics of Tax Competition: A survey and Lessons for the EU. Erasmus Law Review, 4, 3-12.

Baumeister, Roy F. & Mark R. Leary (1997): Writing Narrative Literature Reviews. Review of General Psychology, 1, 311–320.

Beer, Sebastian, de Mooij, Ruud and Liu, Li (2020): International corporate tax avoidance: A review of the channels, magnitudes and blind spots. Journal of Economic Surveys, 3, 660-688.

Bjorvatn, Kjetil and Schelderup, Guttorm (2002): Tax Competition and International Public Goods. International Tax and Public Finance, 9, 111-120.

Black, Dan A. and Hoyt, William H. (1989): Bidding for Firms. The American Economic Review, 79, 1249-1256.

Braid, Ralph M. (2000): A Spatial Model of Tax Competition with Multiple Tax Instruments. Journal of Urban Economics, 47, 88-114.

Braid, Ralph M. (2005): Tax competition, tax exporting and higher-government choice of tax instruments for local governments. Journal of Public Economics, 89, 1789-1821.

Brueckner, Jan. K (2000): A Tiebout/tax-competition model. Journal of Public Economics, 77, 285-306.

Brulhart, Marius and Jametti, Mario (2019): Does tax competition tame the Leviathan? Journal of Public Economics, 177, 104037.

Bucoversky, Sam (1991): Asymmetric Tax Competition. Journal of Urban Economics, 30, 167-181.

Bucovetsky, Sam and Haufler, Andreas (2007): Preferential Tax Regimes with Asymmetric Countries. National Tax Journal, 60, 789-795.

Bucovetsky, Sam and Wilson, John (1991): Tax competition with two tax instruments. Regional Science and Urban Economics, 21, 333-350.

Chamley, Christophe (1986): Optimal Taxation of Capital Income in General Equilibrium with Infinite Lives. Econometrica, 54, 607-622.

Chen, Shuping, Chen, Xia, Cheng, Qiang and Shevlin, Terry: (2010) Are family firms more tax aggressive than non-family firms. Journal of Financial Economics, 95, 41–61.

Choi, Jay Pil, Furusawa, Taiji and Ishikawa, Jota (forthcoming): Transfer pricing regulation and tax competition. Journal of International Economics.

Chu, Hsun, Cheng, Chu-Chuan and Lai, Yu-Bong (2015): A political economy of tax havens. International Tax and Public Finance, 22, 956-976.

Devereux, Michael P, Griffith, Rachel and Klemm, Alexander (2002): Corporate income tax reforms and international tax competition. Economic Policy, 17, 449-495.

Devereux, Michael P., Lockwood, Ben and Redoano, Michela (2008): Do countries compete over corporate tax rates? Journal of Public Economics, 92, 1210-1235.

Devereux, Michael P. and Loretz, Simon (2013): What do we know about corporate tax competition? National Tax Journal, 66, 745-774.

Dharmapala, Dhammika (2008): What problems and opportunities are created by tax havens? Oxford Review of Economic Policy, 24, 661-679.

Dharmapala, Dhammika (2014): What Do We Know About Base Erosion and Profit Shifting? A Review of the Empirical Literature. CESifo Working Paper Series No. 4612.

Dharmapala, Dhammika (2019): Profit Shifting in a Globalized World. AEA Papers and Proceedings, 109, 488-492.

Dharmapala, Dhammika and Hines, James R. Jr. (2009): Which countries become tax havens? Journal of Public Economics, 93, 1058–1068.

Edwards, Jeremy and Keen, Michael (1996): Tax competition and Leviathan. European Economic Review, 40, 113-134.

Egger, Peter and Raff, Hort (2015): Tax rate and tax base competition for foreign direct investment. International Tax and Public Finance, 22, 777-810.

Egger, Peter and Seidel, Tobias (2011): Tax competition, trade liberalization, and imperfect labour markets. Oxford Economic Papers, 63, 722-739.

Eichner, Thomas (2014): Endogenizing leadership and tax competition: Externalities and public good provision. Regional Science and Urban Economics, 46, 18-26.

Eichner, Thomas and Pethig, Rüdiger (2020): Kant-Nash tax competition. International Tax and Public Finance, 27, 1108-1147.

Eichner, Thomas and Runkel, Marco (2011): Corporate income taxation of multinationals in a general equilibrium model. Journal of Public Economics, 95, 723-733.

Eichner, Thomas and Upmann, Thorsten (2012): Labor markets and capital tax competition. International Tax and Public Finance, 19, 203-215.

Exbrayat, Nelly, Gaigné, Carl and Riou, Stéphane (2012): The effects of labour unions on international capital tax competition. The Canadian Journal of Economics, 45, 1480-1503.

Euroopan unionin neuvosto (2020): Neuvoston päätelmät veroasioissa yhteistyöhaluttomia lainkäyttöalueita koskevasta tarkistetusta EU:n luettelosta Hyväksyminen.

Faulhaber, Lilian V. (2017): The Trouble with Tax Competition. Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association, 110, 1-63.

Feld, Lars and Heckemeyer, Jost (2011): FDI and Taxation: A meta-study. Journal of Economics Surveys, 25, 233-272.

Ferrett, Ben and Wooton, Ian (2010): Competing for a duopoly: international trade and tax competition. The Canadian Journal of Economics, 43, 776-794.

Ferrett, Ben and Wooton, Ian (2020): Targeting FDI. International Tax and Public Finance, https://doi.org/10.1007/s10797-020-09628-z, viewed 22.12.2020.

Forbes, Kevin F. and Zampelli, Ernest M. (1989): Is Leviathan a Mythical Beast? The American Economic Review, 79, 568-577.

Fuest, Clemens, Hugger, Felix and Wildgruber, Susanne (2020): Why Is Corporate Tax Revenue Stable While Tax Rates Fall? Evidence from Firm-Level Data. CESifo Working Paper No. 8605.

Furusawa, Taiji, Hori, Kazumi and Wooton, Ian (2015): A race beyond the bottom: the nature of bidding for a firm. International Tax and Public Finance, 22, 452-475.

Garcia Pires, Armando Jose (2013): The business model of the Virgin Islands and Panama. SNF Working Paper, No 31/13.

Genschel, Philipp and Schwarz, Peter (2011): Tax competition: a literature review. Socio-Economic Review, 9, 339-370.

Gordon, Roger H. (1986): Taxation of Investment and Savings in a World Economy. The American Economic Review The American Economic Review, 76, 1086-1102.

Gordon, Roger H. (1992): Can Capital Income Taxes Survive in Open Economies? The Journal of Finance, 47, Papers and Proceedings of the Fifty-Second Annual Meeting of the American Finance Association, 1159-1180.

Gresik, Thomas A., Schindler, Dirk and Schjelderup, Guttorm (2020): Playing Easy or Playing Hard to Get: When and How to Attract FDI. CESifo Working Paper, No. 8415.

Greenstone, Michael and Moretti, Enrico (2003): Bidding for Industrial Plants: Does Winning a 'Million Dollar Plant'Increase Welfare? NBER Working Paper No. 9844.

Griffith, Rachel and Klemm, Alexander (2004): What has been the tax competition experience of the last 20 years? IFS WP04/05.

Haufler, Andreas and Schjelderup (2000): Corporate tax systems and cross country profit shifting. Oxford Economic Papers, 52, 306-325.

Haufler, Andreas and Wooton, Ian (1999): Country size and tax competition for foreign direct investment. Journal of Public Economics, 71, 121-139.

Heckemeyer, Jost H. and Overesch, Michael (2017): Multinationals' profit response to tax differentials: Effect size and shifting channels. Canadian Journal of Economics, 50, 965-994.

Hindriks, Jean and Nishimura, Yukihiro (2015): A note on equilibrium leadership in tax competition models. Journal of Public Economics, 121, 66-68.

Hindriks, Jean and Nishimura, Yukihiro (2017): Equilibrium leadership in tax competition models with capital ownership: a rejoinder. International Tax and Public Finance, 24, 338-349.

Hines, James R. (1999): Lessons from Behavioral Responses to International Taxation. National Tax Journal, 52, 305-322.

Hong, Qing and Smart, Michael (2010): In praise of tax havens: International tax planning and foreign direct investment. European Economic Review, 54, 82-95.

Hopp, Daniel and Kriebel, Michael (2019): The political economy of interregional competition for firms. Regional Science and Urban Economics, 79, 103485.

Hoyt, William (1991): Property taxation, Nash equilibrium, and market power. Journal of Urban Economics, 30, 123-131.

Hungerbühler, Mathias and Van Ypersele, Tanguy (2014): Tax Competition in Imperfect Labor Markets. Annals of Economics and Statistics, 113, 99-120.

Internal Revenue Service (2020)): Historical Table 24, U.S. Corporation Income Tax: Tax Brackets and Rates. https://www.irs.gov/statistics/soi-tax-stats-historical-table-24, viewed 12.12.2020.

Janeba, Eckhard (1998): Tax competition in imperfectly competitive markets. Journal of International Economics, 44, 135-153.

Janeba, Eckhard and Osterloh, Steffen (2013): Tax and the city - A theory of local tax competition. Journal of Public Economics, 106, 89-100.

Janeba, Eckhard and Schjelderup, Guttorm (2009): The welfare effects of tax competition reconsidered: Politicians and political institutions. The Economic Journal, 199, 1143-1161.

Janeba, Eckhard and Smart, Michael (2001): Is targeted tax competition less harmful than its remedies? CESifo Working Paper No. 590.

Janeba, Eckhard and Wilson, John D. (1999): Tax competition and trade protection. NBER Working Paper, No. 7402.

Jensen, Richard and Toma, Eugenia Froedge (1991): Debt in a model of tax competition. Regional Science and Urban Economics, 21, 371-392.

Johannesen, Niels (2010): Imperfect tax competition for profits, asymmetric equilibrium and beneficial tax havens. Journal of International Economics, 81, 253-264.

Judd, Kenneth L. (1985): Redistributive taxation in a simple perfect foresight model. Journal of Public Economics, 28, 59-83.

Kanbur, Ravi and Keen, Michael (1993): Jeux Sans Frontières: Tax Competition and Tax Coordination When Countries Differ in Size. The American Economic Review, 83, 877-892.

Karabarbounis, Loukas and Neiman, Brent (2014): The Global Decline of the Labor Share. The Quartely Journal of Economics, 129, 61-103.

Kari, Seppo and Lönnqvist, Henrik (2001): "Poimintoja taloustieteellisestä verokilpailututkimuksesta" in Hjerppe, Reino, Kari, Seppo and Lönnqvist, Henrik (ed.), Verokilpailu ja verotuksen kehittämistarpeet. VATT-Keskustelualoitteita 261.

Kari, Seppo and Ropponen, Olli (2018): Globalisaatio, digitalisaatio ja kansainvälinen yritysverotus. VATT Muistiot 55.

Kato, Hayato (2015): The imporance of government commitment in attracting firms: A dynamic analysis of tax competitio in an agglomeration economy. European Economic Review, 74, 57-58.

Kawachi, Keisuke, Ogawa, Hikaru and Susa, Taiki (2019): Endogenizing government's objectives in tax competition with capital ownership. International Tax and Public Finance, 26, 571-594.

Keen, Michael (2001): Preferential Regimes Can Make Tax Competition Less Harmful. National Tax Journal, 54, 757-762.

Keen, Michael and Konrad, Kai A. (2013): "The Theory of International Tax Competition and Coordination" in Auerbach, Alan J., Chetty, Raj, Feldstein, Martin and Saez, Emmanuel (ed.) Handbook of Public Economics, Volume 5, Elsevier.

Keen, Michael J. and Kotsogiannis, Christos (2004): Tax competition in federations and the welfare consequences of decentralization. Journal of Urban Economics, 56, 397-407.

Keen, Michael J. and Marchand, Maurice (1997): Fiscal competition and the pattern of public spending. Journal of Public Economics, 66, 33-53.

Kempf, Hubert and Rota-Graziosi, Grégoire (2010): Endogenizing leadership in tax competition. Journal of Public Economics, 94, 768-776.

Konrad, Kai A. (2011): Search costs and corporate income tax competition. Economics Letters, 112, 213-215.

Krautheim, Sebastian and Schmidt-Eisenlohr, Tim (2011): Heterogeneous firms, 'profit shifting' FDI and international tax competition. Journal of Public Economics, 95, 122-133.

Krautheim, Sebastian and Schmidt-Eisenlohr, Tim (2016): Wages and International Tax Competition. Review of International Economics, 24, 893-923.

Lai, Yu-Bong (2014): Asymmetric tax competition in the presence of lobbying. International Tax and Public Finance, 21, 66-86.

Langenmayr, Dominika, Haufler, Andreas and Bauer, Christian J. (2015): Should tax policy favor high- or low-productivity firms? European Economic Review, 73, 18-34.

Lee, Kangoh (1997): Tax Competition with Imperfectly Mobile Capital. Journal of Urban Economics, 42, 222-242.

Leibrecht, Markus and Hochgatterer, Claudia (2012): Tax competition as a cause of falling corporate income tax rates: A survey of empirical literature. Journal of Economic Surveys, 26, 616-648.

Lejour, Arjan and Verbon, Harrie (1997): Tax Competition and Redistribution in a Two-Country Endogenous-Growth Model. International Tax and Public Finance, 4, 485-497.

Lisowsky, Petro (2010): Seeking Shelter: Empirically Modeling Tax Shelters Using Financial Statement Information. The Accounting Review, 85, 1693–1720.

Loretz, Simon and Notes, Author (2008): Corporate taxation in the OECD in a wider context. Oxford Review of Economic Policy, 24, 639-660.

Lumme, Mikko ja Ropponen, Olli (2020): Monikansallisten yritysten voitonsiirto ja yhteisöveropohjan rapautuminen – kokoluokan arviointia kansainvälisen kirjallisuuden valossa. VATT Muistiot 58.

Mardan, Mohammad and Stimmelmayr, Michael (2020): Tax competition between developed, emerging, and developing countries - Same same but different? Journal of Development Economics, 146, 102491.

McAfee, Preston R. and McMillan, John (1987): Auctions and Bidding. Journal of Economic Literature, 25, 699-738.

Mendoza, Enrique G. and Tesar, Linda L. (1998): The International Ramifications of Tax Reforms: Supply-Side Economics in a Global Economy. The American Economic Review, 88, 226-245.

Mendoza, Enrique G. and Tesar, Linda L. (2005): Why hasn't tax competition triggered a race to the bottom? Some quantitative lessons from the EU. Journal of Monetary Economics, 52, 163-204.

Mirrlees, James, Adam, Stuart, Besley, Tim, Blundell, Richard, Bond, Stephen, Chote, Robert, Gammie, Malcolm, Johnson, Paul, Myles, Gareth and Poterba, James M. (2011): Tax by Design. Oxford University Press.

Mooij, Ruud A. De, Nicodème, Gaëtan J.A (2008): Corporate tax policy and incorporation in the EU. International Tax and Public Finance, 15, 478-498.

Morita, Tadashi, Sato, Yasuhiro and Yamamoto, Kazuhiro (2020): Demographics and competition for capital in political economy. International Tax and Public Finance, 27, 865–889.

Noiset, Luc (2003): Is it tax competition or tax exporting? Journal of Urban Economics, 54, 639-647.

Oates, Wallace E. (1972): Fiscal Federalism. Harcourt Brace Jovanovich, New York.

Oates, Wallace E. (1985): Searching for Leviathan: An Empirical Study. The American Economic Review, 75, 748-757.

Oates, Wallace E. (1989): Searching for Leviathan: A Reply and Some Further Reflections. The American Economic Review, 79, 578-583.

OECD (1998): Hamrful Tax Competition: An Emerging Global Issue.

OECD (2019): Corporate Tax Statistics. First Edition.

OECD (2020a): Tax Challenges Arising from Digitalisation – Report on Pillar One Blueprint: Inclusive Framework on BEPS, OECD/G20 Base Erosion and Profit Shifting Project. OECD Publishing, Paris.

OECD (2020b): Tax Challenges Arising from Digitalisation – Report on Pillar Two Blueprint: Inclusive Framework on BEPS, OECD/G20

Base Erosion and Profit Shifting Project. OECD Publishing, Paris.

Ogawa, Hikaru (2013): Further analysis on leadership in tax competition: the role of capital ownership. International Tax an public Finance, 20, 474-484.

Ogawa, Hikaru, Sato, Yasuhiro and Tamai, Toshiki (2006): A note on unemployment and capital tax competition. Journal of Urban Economics, 60, 350-356.

Ogawa, Hikaru, Sato, Yasuhiro and Tamai, Toshiki (2016): Who gains from capital market integration? Tax competition between unionized and non-unionized countries. The Canadian Journal of Economics, 49, 76-110.

Ogura, Laudo M. (2006): A note on tax competition, attachment to home and underprovision of public goods. Journal of Urban Economics, 59, 252-258.

Pal, Rupayan and Sharma, Ajay (2013): Endogenizing government‘objectives in tax competition. Regional Science and Urban Economics, 43, 570-578.

Pal, Rupayan and Sharma, Ajay (2019): Preferences over Public Good, Political Delegation and Leadership in Tax Competition. Public Finance Review, 47, 718-746.

Persson, Torsten and Tabellini, Guido (1990): The politics of 1992: Fiscal policy and the European integration. NBER Working Paper, No. 3460.

Pieretti, Patrice and Skerdilajda, Zanaj (2011): On tax competition, public goods provision and jurisdictions‘ size. Journal of International Economics, 84, 124-130.

Razin, Assaf and Sadka, Efraim (2011): Tax Competition and Migration: The Race-to-the-Bottom Hypothesis Revisited. NBER Working Paper 16670.

Richardson, Grant, Taylor, Grantley and Lanis, Roman (2013): The impact of board of director oversight characteristics on corporate tax aggressiveness: An empirical analysis. Journal of Accounting and Public Policy, 32, 68–88.

Rodriguez, Francisco and Jayadev, Arjun (2010): The Declining Labor Share of Income. The Human Development Research Paper Series, 36/2010.

Roemer, Christina D. and Romer, David H. (2010): The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks. American Economic Review, 100, 763-801.

Roemer, John E. (2010). Kantian equilibrium. Scandinavian Journal of Economics, 112, 1–24.

Roemer, John E. (2015). Kantian optimization: A micro foundation for cooperation. Journal of Public Economics, 127, 45–57.

Rota-Graziosi, Grégoire (2019): The supermodularity of the tax competition game. Journal of Mathematical Economics, 83, 25-35.

Saez, Emmanuel and Stantcheva, Stefanie (2018): A simpler theory of optimal capital taxation. Journal of Public Economics, 162, 120-142.

Salminen, Ari (2011): Mikä kirjallisuuskatsaus? Johdatus kirjallisuuskatsauksen tyyppeihin ja hallintotieteellisiin sovelluksiin. Vaasan yliopiston julkaisuja.

Samuelson, Paul A. (1954): The Pure Theory of Public Expenditure. The Review of Economics and Statistics, 36, 387-389.

Schjelderup, Guttorm (2015): Taxing Mobile Capital and Profits: The Nordic Welfare States. Nordic Economic Policy Review, 2/2015.

Sirviö, Tom-Henrik (2020): Arvioita sosiaaliturvan menojen pitkän aikavälin kehityksestä. Sosiaali- ja terveysministeriön raportteja ja muistioita 17:2020.

Sirviö, Tom-Henrik (forthcoming): Verovälttelyn taloustiede. VATT Muistiot.

Slemrod, Joel (1992): Do Taxes Matter? Lessons from the 1980's. The American Economic Review , 82, Papers and Proceedings of the Hundred and Fourth Annual Meeting of the American Economic Association, 250-256.

Slemrod, Joel (2018): Is This Tax Reform, or Just Confusion? Journal of Economic Perspective, 32, 73–96.

Slemrod, Joel and Wilson, John. D (2009): Tax competition with parasitic tax havens. Journal of Public Economics, 93, 1261-1270.

Straub, Ludwig and Werning, Iván (2020): Positive Long-Run Capital Taxation: Chamley-Judd Revisited. American Economic Review, 110, 86-119.

Taylor, Alan M. (2009): The global 1970s and the echo of the great depression. NBER Working Paper, No. 15475.

Tiebout, Charles M. (1956): A Pure Theory of Local Expenditures. Journal of Political Economy, 64, 416-424.

Tørsløv, Thomas R., Wier, Ludvig S. and Zucman, Gabriel (2018): The Missing Profits of Nations. NBER Working Paper No. 24701.

Traub, Stefan and Yang, Hongyan (2020): Tax Competition and the Distribution of Income. Scandinavian Journal of Economics, 122, 109-131.

Vroey, Michel De (2016): A History of Macroeconomics from Keynes to Lucas and Beyond. Cambridge University Press, New York.

Wang, Wenming and Ogawa, Hikaru (2018): Objectives of governments in tax competition: Role of capital supply elasticity. International Review of Economics and Finance, 54, 225-231.

Wang, Fangjun, Xu, Shuolei and Sun, Junqin (2020): Corporate tax avoidance: A literature review and research agenda. Journal of Economic Surveys, 34, 739-811.

Weisbach, David A. (2004): Corporate Tax Avoidance. John M. Olin Program in Law and Economics Working Paper, No. 202, 2004.

Wildasin, David E. (1989): Interjurisdictional Capital Mobility: Fiscal Externality and a Corrective Subsidy. Journal of Urban Economics, 25, 193-212.

Wilson, John Douglas (1986): A Theory of Interregional Tax Competition. Journal of Urban Economics, 19, 296-315.

Wilson, John Douglas (1987): Trade, Capital Mobility, and Tax Competition. Journal of Political Economy, 95, 835-856.

Wilson, John Douglas (1991): Tax competition with interregional differences in factor endowments. Regional Science and Urban Economics, 21, 423-451.

Wilson, John Douglas (1999): Theories of Tax Competition. National Tax Journal, 52, 269-304.

Wilson, John Douglas and Janeba, Eckhard (2005): Decentralization and international tax competition. Journal of Public Economics, 89, 1211-1229.

Wilson, John Douglas and Wildasin, David E. (2004): Capital tax competition: bane or boon. Journal of Public Economics, 88, 1065– 1091.

Yang, Hongyan (2015): Optimal Income Redistribution and Capital Market Intergration. FinanzArchiv, 71, 460-473.

Yang, Hongyan (2018): Income redistribution and public goods provision under tax competition. Journal of Urban Economics, 104, 94-103.

Zax, Jeffrey S. (1989):: Is There a Leviathan in Your Neighborhood? The American Economic Review, 79, 560-567.

Zodrow, George R. (2003): Tax Competition and Tax Coordination in the European Union. International Tax and Public Finance, 10, 651-571.

Zodrow, George R. (2010): Capital Mobility and Capital Tax Competition. National Tax Journal, 63, 865-902.

Zodrow, George. R. and Mieszkowski, Peter (1986): Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods. Journal of Urban Economics, 19, 356-370.

Zucman, Gabriel (2014): Taxing across Borders: Tracking Personal Wealth and Corporate Profits. Journal of Economic Perspectives, 28, 121–148.